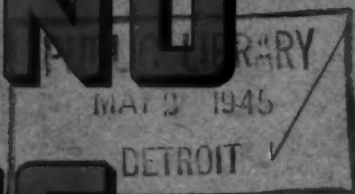


ROADS AND STREETS

APRIL 1945



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ALASKA ROAD JOB



When the Alaska Road Commission, U. S. Department Of The Interior, decided to improve the Fairbanks-Valdez road—one of the most important in the country, they were faced with a considerable tunneling job in Keystone Canyon—mostly through solid rock.

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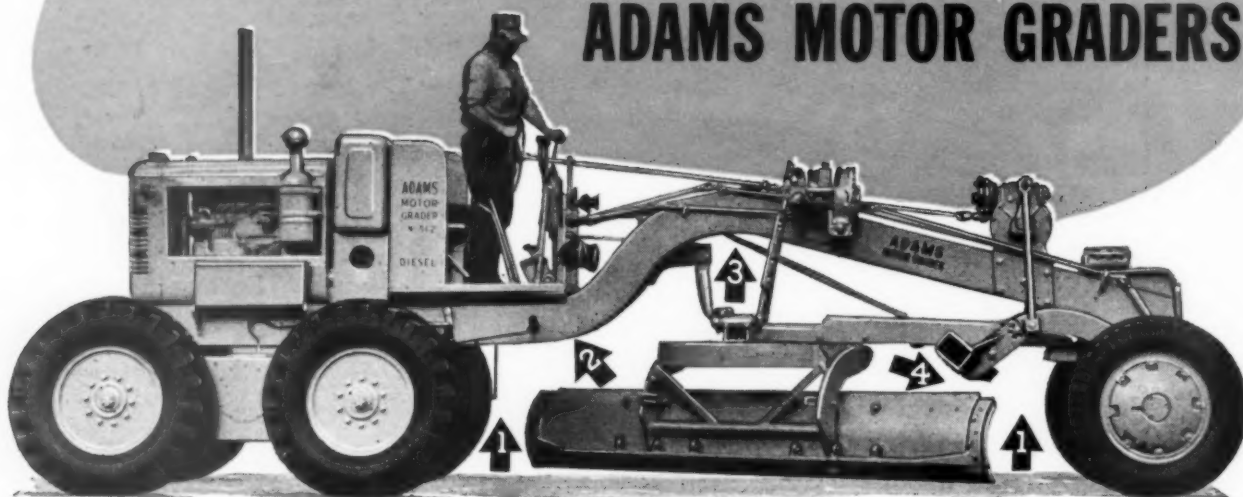
As usual, Timken "M" Type Bits delivered good footage and reduced drilling costs all around. Any rock drilling job can be done better, quicker, at lower cost with Timken Rock Bits. Are you using them? If not, your drilling may be costing you more than it should. Swing to Timken Removable Rock Bits and watch your drilling costs drop. The Timken Roller Bearing Company, Canton 6, Ohio.

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ROCK BITS

PLENTY OF BLADE CLEARANCE!

IN ALL OPERATING POSITIONS WITH

ADAMS MOTOR GRADERS



Action photo of ditching operation showing how wide blade end and scarifier clearances speed free movement of dirt.

WIDE BLADE clearance—in all operating positions—is an inherent advantage in all Adams Motor Graders. Note in photo above how Adams' advanced design provides generous clearances at these critical points:

- ① Between blade ends and tires, permitting sharp blade angles without tire interference.
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- ③ Between blade and frame arch, permitting higher blade lift for ground clearances.
- ④ Between blade and scarifier block for easy reversing of blade under scarifier.

Thus, operators may maneuver blade into widest range of positions, without interference with wheels, frame or scarifier—promoting efficient, high-speed production. Ask your local dealer for the full story about Adams Motor Graders and their many job applications.



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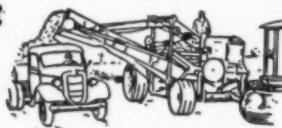
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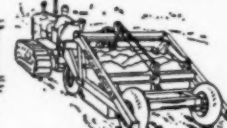
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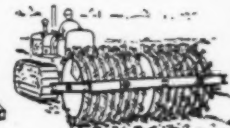
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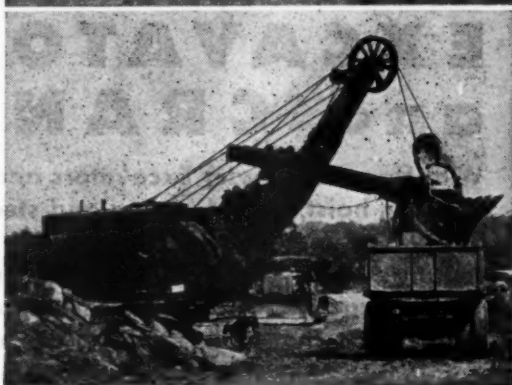
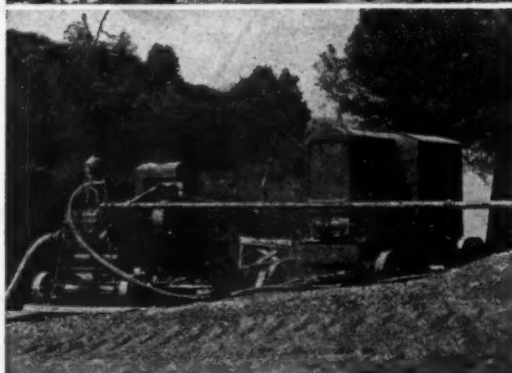
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Vol. 88, No. 4

April, 1945



A magazine devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations, and to the construction and maintenance of airports.

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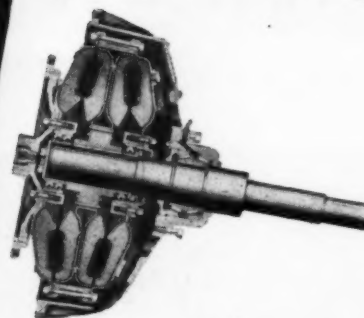
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YOU can tackle a mountain of rock—or any other tough job—with a Lorain 82 and get the most out of every work-minute! These husky shovels are equipped with a life-saving, shock-absorbing hydraulic coupling that smooths out heaviest digging shocks and keeps the engine pulling at peak power under toughest loads. You just can't stall the engine!

No matter how big the rock or how tight it's lodged, the Lorain 82 hangs on until it's in the dipper. Sudden jerks, impacts and other shocks are cushioned by the spinning oil clutch—eliminating stress and strain on mechanism and cables and greatly lessening operator fatigue.

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If you want shovel performance that's literally "smooth as oil" and new, low per-yard handling costs, write for complete data on the shockproofed shovel.



Power for the Lorain 82 flows through this hydraulic coupling. Shocks impacts and sudden strains on the mechanism and cables are cushioned and absorbed by the fluid connection.

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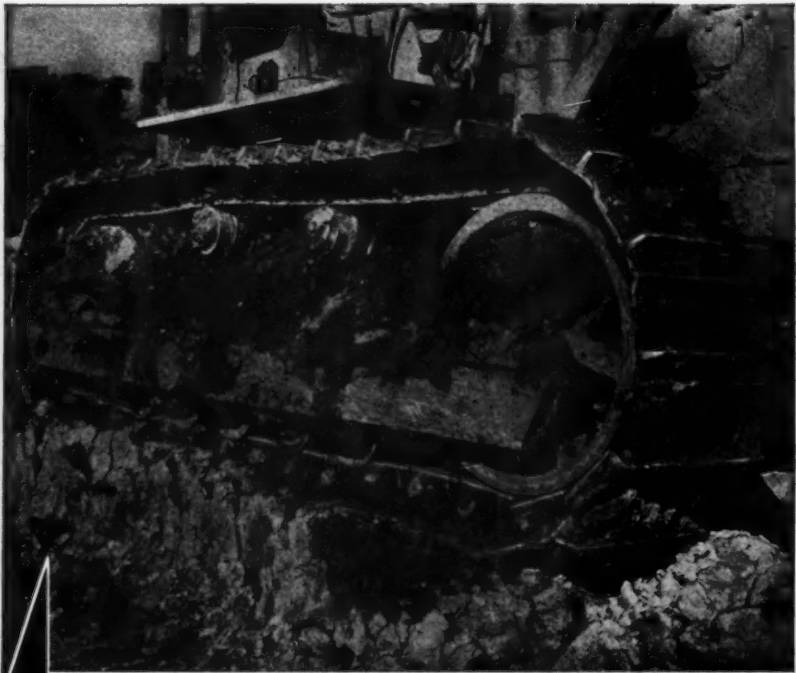
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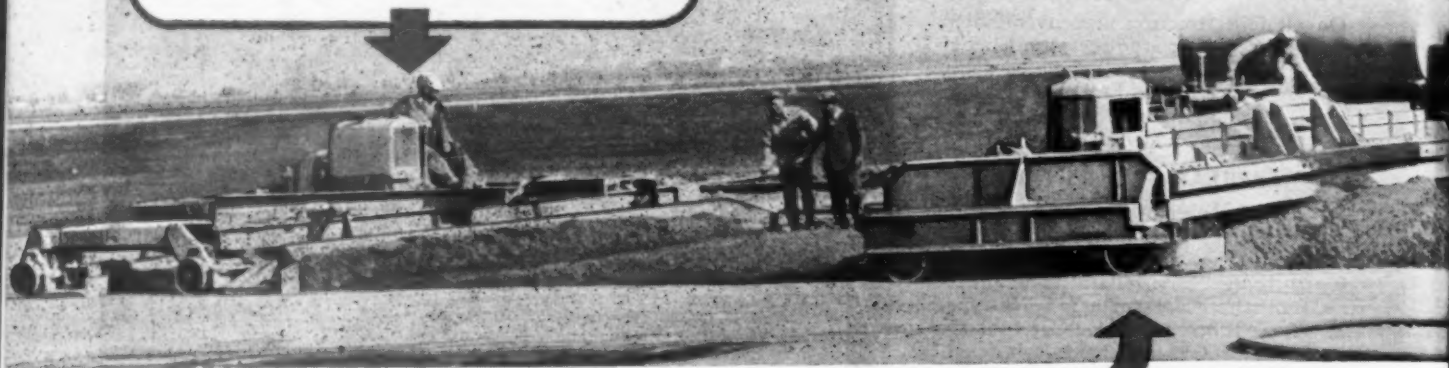


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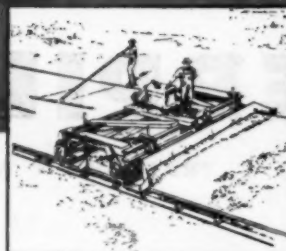
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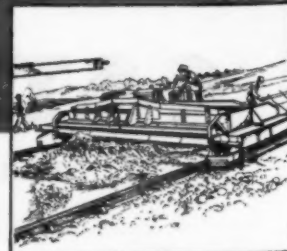
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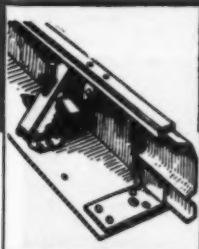
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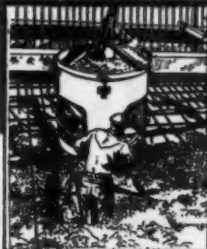
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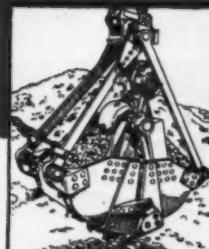
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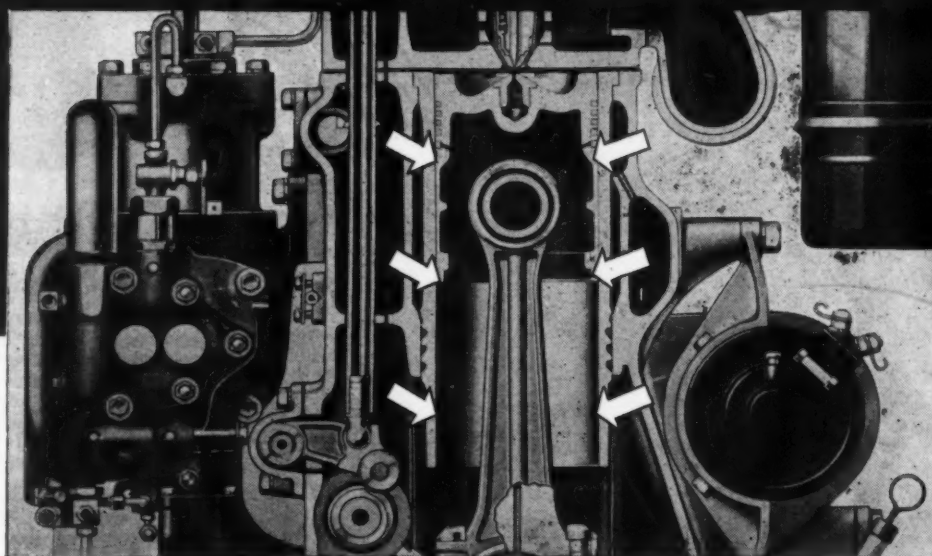


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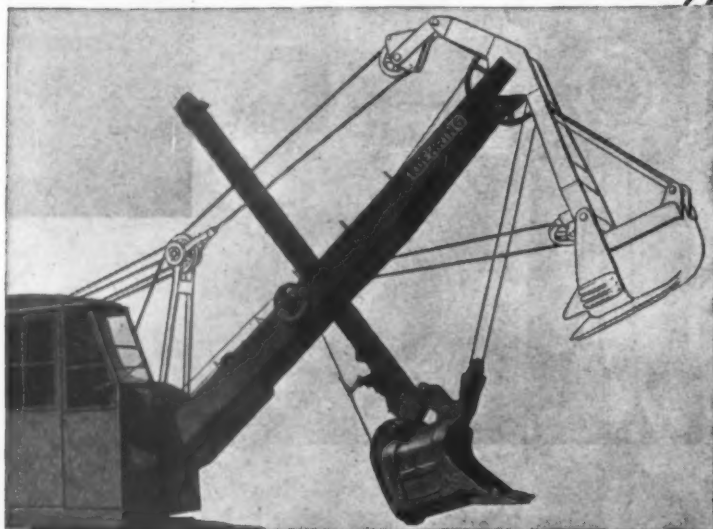
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KOEHRING CO. - Milwaukee 10, Wis.

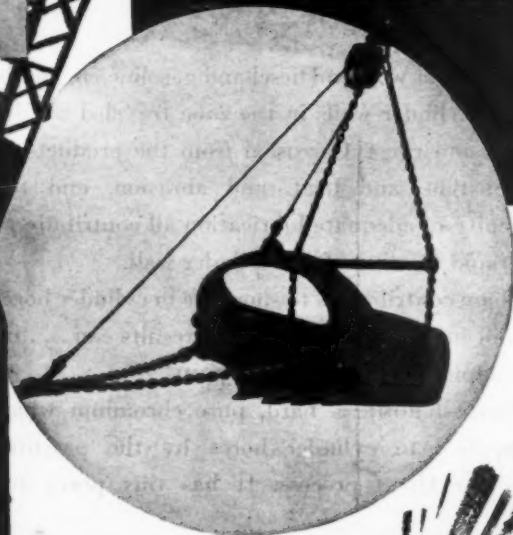


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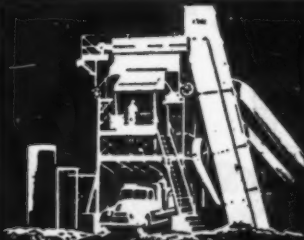
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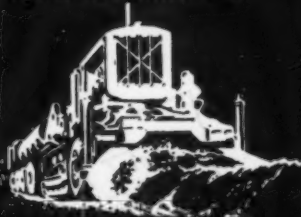


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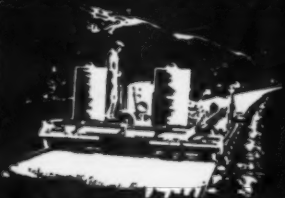
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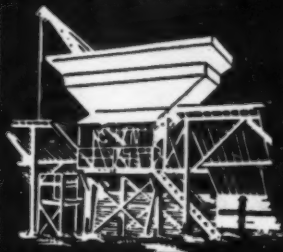
ROAD PUGS

Cap.—200 to 550 tons
per hr. Record re-
ported—7920 tons in
20 hrs. (396 tons per
hr.) Phoenix Cons. Co.



CEMENT FINISHERS

Cap.—300 lin. ft. per
hr. Record reported—
3065 lin. ft. in 8-hr.
(383 ft. per hr.) Albany,
Ore. by Roy Houck.



AGGREGATE BATCHERS



ROLL-TAMP COMPACTORS

The Madsen line of bituminous mixing plants, the most complete offered by any manufacturer, includes: Asphalt Plants in 6 sizes (500- to 6,000-lb.), Oil-Mix Plants in 5 sizes (1,000- to 6,000-lb.) and the Road P...

WANT TO SPEED UP

The Madsen line of bituminous mixing plants, the most complete offered by any manufacturer, includes: Asphalt Plants in 6 sizes (500- to 6,000-lb.), Oil-Mix Plants in 5 sizes (1,000- to 6,000-lb.) and the Road P...

ROAD CONSTRUCTION?

The Johnson Float Finisher makes a smoother finish faster than possible by hand or by any other type of mechanical finisher.

...GET THE LOWDOWN

Write
for
Catalog

MADSEN IRON WORKS
HUNTINGTON PARK, CALIFORNIA

★ A Star Performance - Road-Ability Plus Digging Speed ★

In the wheel-mounted utility crane Model UC 55, Link-Belt Speeder has developed a mobile unit that goes places in a hurry — to do the score of different jobs that make up the schedule of state highway, county or township road departments and contractors.

Fast — it gets about on highways at ten miles per hour!

Powerful — swings a half-yard dipper and has a lifting capacity of 6 tons.

Quickly Convertible — use it as shovel, dragline, crane, trench hoe, pile driver or clamshell.

Easy to Operate — result of advanced engineering and hydraulic controls. Built for long life, trouble-free operation. Send for folder 2051, today!

GET A
BIG
BITE
WITH A
LINK-BELT
SPEEDER



For Prompt, Efficient, Convenient Sales and Service, There is a Link-Belt Speeder Distributor Located Near You.

LINK-BELT SPEEDER



A-C Diesel Tractors Simplify Upkeep



There is no need to keep a supply of many different grades of oil and special engine parts for each 2-cycle Diesel model. Uniform design and manufacture permit convenient interchange on all models of Allis-Chalmers Diesel tractors.

The same approved oil used in the 200-hour truck rollers, support rollers and front idlers may also be used in the transmission and final drives. Makes lubrication simple, fast, economical.

Interchange of engine parts among all models saves you additional time and money,

simplifies repairs, reduces inventory. The same sleeves, pistons, rings, connecting rods, injectors and other engine parts will fit the HD-14, HD-10, HD-7 tractors and the A-D Motor Grader.

It pays to be an Allis-Chalmers owner . . . particularly a fleet owner! Investigate the many EXTRA advantages of modern 2-cycle Diesel power.

FIGHT TO VICTORY WITH WAR BONDS

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

• 2-Cycle . . . THE MODERN DIESEL POWER

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MARION

HAS THE ANSWER!

What is Your Material Handling Problem?

Construction will benefit materially from the billions of dollars now being set aside for postwar developments.

To meet the demand that will exist for proven equipment, MARION has a machine of the right size and type from $\frac{3}{4}$

cubic yard to 35 cubic yards.

Put a fast, powerful MARION on that postwar job—then watch the rock and dirt fly!

Let's discuss your problems!



THE MARION STEAM SHOVEL CO. • MARION, OHIO
SHOVELS • DRAGLINES • CRANES • PULL-SHOVELS
CLAMSHELLS • WALKERS • *from $\frac{3}{4}$ cu. yd. to 35 cu. yds.*

Our job in this war is by no means done.
With the will to do more than promised, let
not the verdict of anything "less than our
best" soil our reputation.

GALION

MOTOR GRADERS AND ROLLERS

for
ROAD AND AIRPORT
CONSTRUCTION



The Galion Iron Works
and Mfg. Co.

GALION - - - - OHIO

U. S. Signal Corps photo.

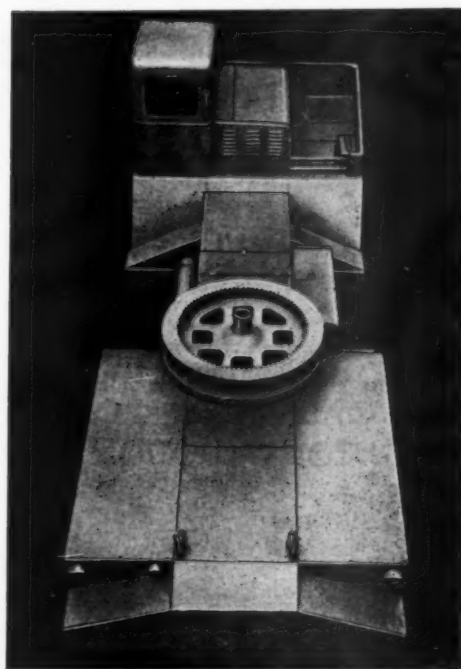


Built to take the **TOUGHEST** **STRESSES** and **STRAINS**

From every angle, the Michigan Shovel-Crane is a "brute for punishment" — always ready to take the toughest stresses and strains without a whimper. Glance at the illustrations of the frame-chassis below, and you'll see one of the main reasons why. But, equally important — balanced design and outriggers (optional) distribute weight on the big, rugged pneumatic tires in such a way as to provide maximum stability and low unit ground pressures. As a result, Michigans can work and travel in really tough spots with speed and safety. Peak performance — even under adverse conditions — is always assured. Get all the facts about Michigan $\frac{3}{8}$ and $\frac{1}{2}$ yard shovels — with crane attachments of 6, 10, and 12 ton capacities. Write for Bulletin RS-45.



Rugged chassis and frame of box type members, fabricated of high-tensile alloy steel, riveted and welded to provide maximum strength and minimum weight. Easily withstands stresses and strains.



MICHIGAN

POWER SHOVEL COMPANY

BENTON HARBOR, MICHIGAN



RUGGED...

Another Feature of **VICKERS** HYDRAULIC POWER STEERING SYSTEM

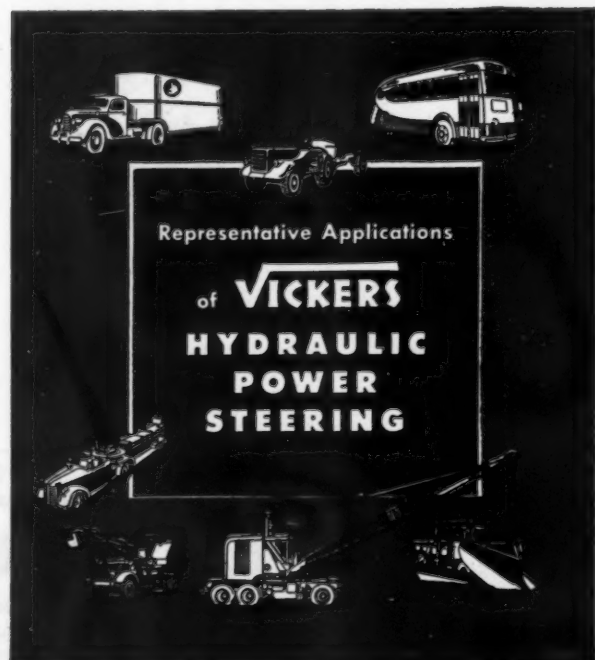
Providing effortless, positive, and shockless steering of even the heaviest vehicles, Vickers Hydraulic Power Steering has been in use under the most adverse operating conditions for the last 14 years. The hydraulic system is protected against overload by the relief valve which limits the maximum hydraulic pressure of the system. The pump and booster are thus protected against damage from excessive pressure and the linkage system from abuse. With Vickers Hydraulic Power Steering, road shock thrusts are transmitted to the frame of the vehicle instead of to the steering gear.

Among the many other advantages of Vickers Hydraulic Power Steering are: greater driver efficiency by reducing fatigue to a minimum, easy application to existing chassis designs, wheel "fight" is impossible, greater road safety, and automatic lubrication. Ask for new Bulletin 44-30 for all the facts about the Vickers Hydraulic Power Steering System.

VICKERS Incorporated

1432 OAKMAN BLVD. • DETROIT 32, MICHIGAN

Application Engineering Offices: CHICAGO • CINCINNATI • CLEVELAND • DETROIT
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JACK OF ALL JOBS-

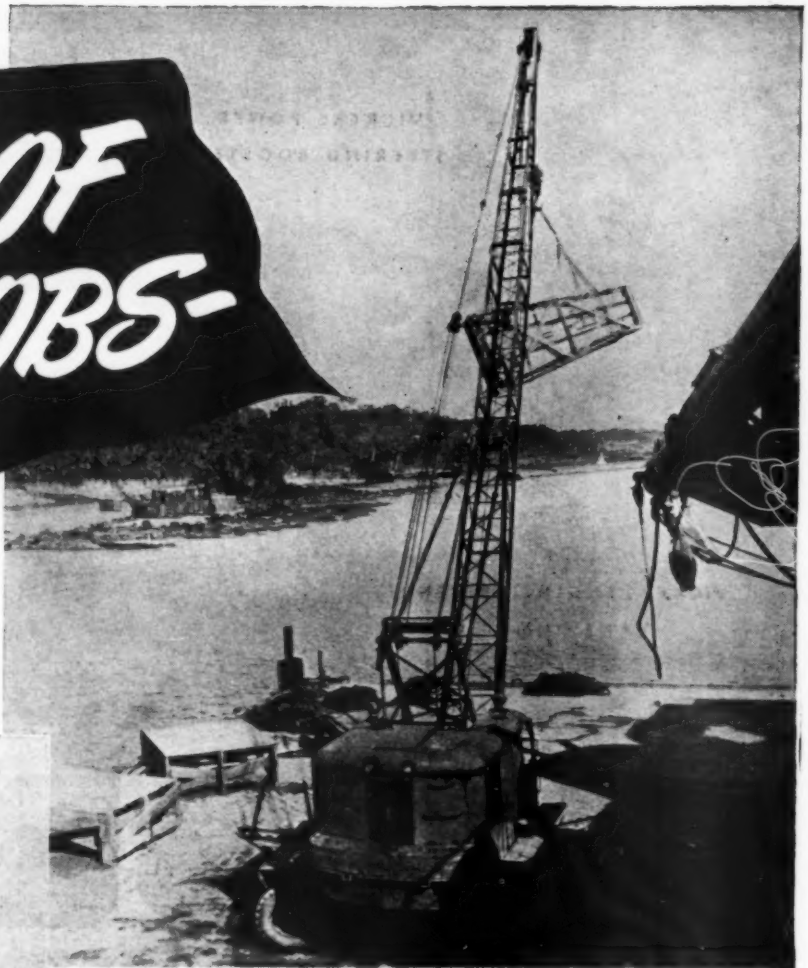
**in heavy materials
handling**



Osgood "20" driving piles for a landing pier in North Africa.



Helping to clear the way to Berlin and Victory, "Fighting Osgoods" serve under fire with Army Engineers in Europe, as well as on other battle fronts.



Above—Vital supplies and equipment being unloaded by a "Fighting Osgood Mobilcrane" in the South Pacific.

"FIGHTING OSGOODS" LIFT, DIG AND DRIVE IN THE BATTLE OF SUPPLY

When the engineer troops and SeaBees "go in" on the heels of our attacking forces, they need the right equipment to do a multitude of jobs quickly and efficiently. Roads and air fields must be leveled, loading docks built, supplies loaded and unloaded, rubble cleared away fast.

Osgood shovels and cranes figure dependably in all these operations . . . working as crane, pile driver and shovel. They're engineered with the power, stamina and versatility to keep precision planning and production on schedule. You'll appreciate these advantages when *your* planning goes into action after Victory.

WHEN IT'S WAR BONDS, BUY MORE THAN BEFORE!

THE
GENERAL
EXCAVATOR COMPANY
**CRANES, DRAGLINES
AND SHOVELS**
DIESEL, GAS, ELECTRIC

Associated with The General Excavator Company

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SHOVELS, DRAGLINES
CRANES

the
 "business
 end"
 of
 a...



MARMON-HERRINGTON *All-Wheel-Drive* CONVERTED FORD

It's the *front-end* of a Marmon-Herrington *All-Wheel-Drive* converted Ford that really gives "the business" to mud, sand, snow, steep grades and all other types of "tough going."

Of course, the rear axle and its wheels are doing their part too—but it is the *added power and traction through the front wheels* that give this truck its outstanding ability—and enable it to out-perform any conventional drive truck off the highway, regardless of size or engine power.

Marmon-Herrington built trucks are still going to war. Substantial numbers of them are leaving our plant each week, going to join the many Marmon-Herrington *All-Wheel-Drive* trucks, track-laying tractors and combat tanks now at the battle fronts.

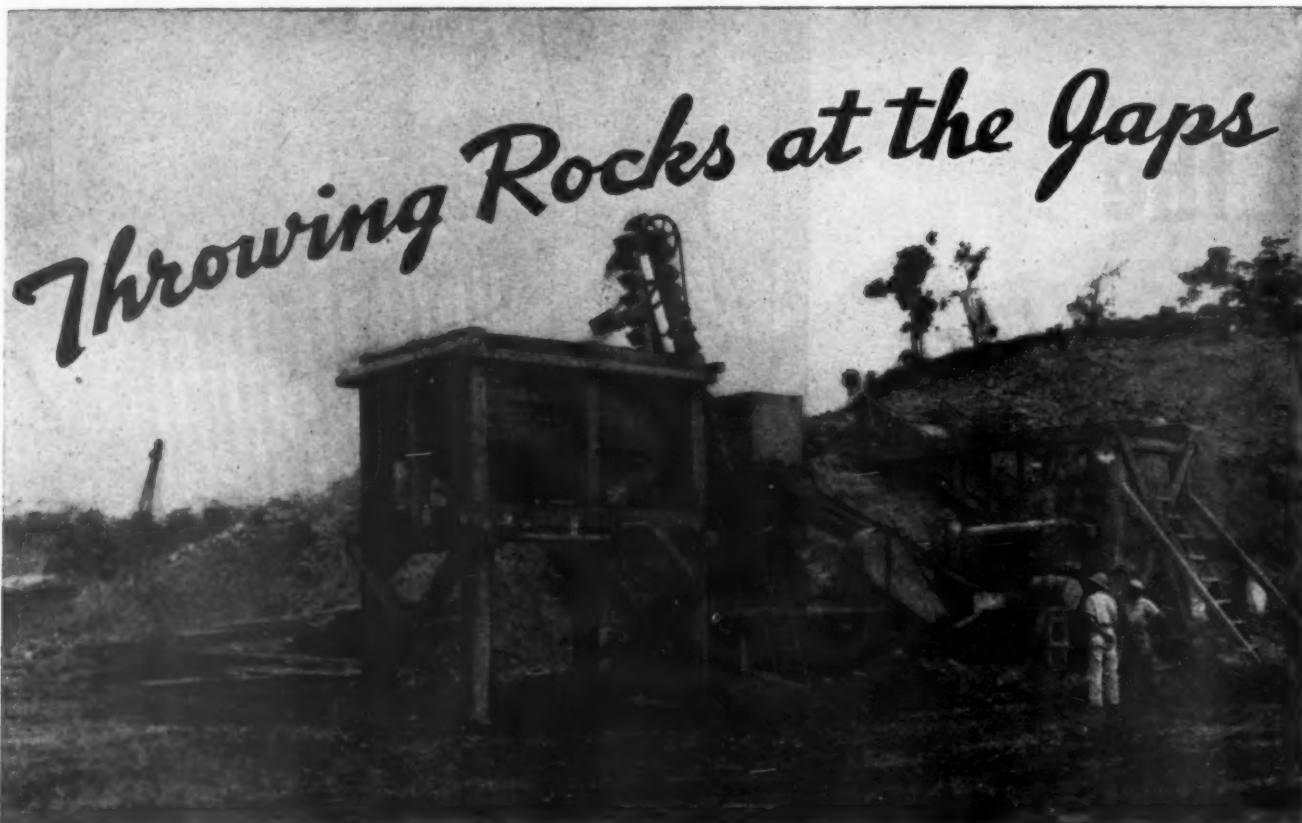
But there's a possibility that you may be able to get delivery of a Marmon-Herrington *All-Wheel-Drive* for your work soon. Better get your order in line!

BUY MORE IN '45 • WAR SAVINGS BONDS

MARMON-HERRINGTON

All-Wheel-Drive **TRUCKS**

MARMON-HERRINGTON CO., Inc., INDIANAPOLIS 7, INDIANA
 Cable Address: MARTON



As fast as the Japs are pushed back from South Pacific Islands, air bases are established. Knowing there would be need for a single, highly mobile rock crushing plant, Universal engineers — early in the war — designed such a plant. Scores of them are in use from Australia to almost the gates of Tokyo.

Designated our No. 522-Q, these plants consist of a 20" x 36" Series "SL" primary jaw crusher mounted on a steel-wheeled truck with power unit and conveyor. Crushed material from the primary is fed to a grizzly with bypass placed over the truck-mounted 30" x 18"

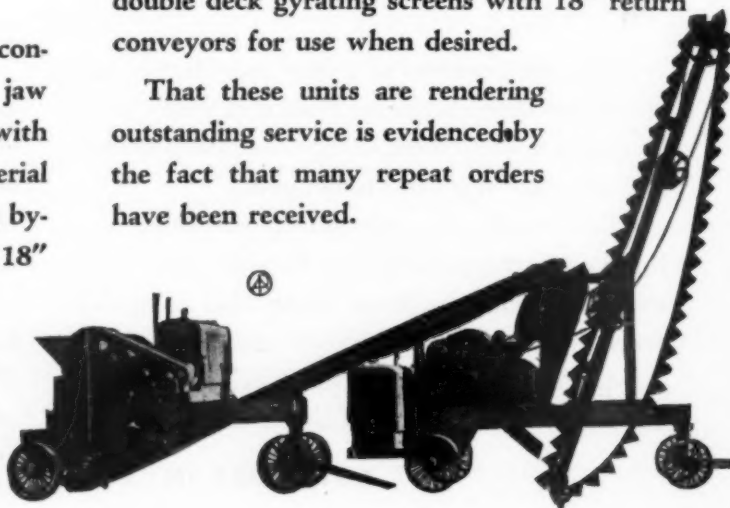
secondary roll crusher, oversize chuting to the roll crusher and throughs going to a bucket elevator boot. Elevator discharges into bin made of native materials to load trucks for hauling to landing strips under construction.

All the plants are provided with 3' x 8' double deck gyrating screens with 18" return conveyors for use when desired.

That these units are rendering outstanding service is evidenced by the fact that many repeat orders have been received.

UNIVERSAL ENGINEERING CORPORATION

631 C Ave. West, Cedar Rapids, Iowa



UNIVERSAL

ROCK AND GRAVEL CRUSHERS, CRUSHING ROLLS, HAMMER MILLS, COMPLETE CRUSHING AND SCREENING PLANTS, WASHING PLANTS, ASPHALT PLANTS, SPREADERS.

MORE AIR FASTER!

**WHEN YOU USE
SCHRAMM AIR COMPRESSORS**

So you've another tough construction job that calls for an air compressor able to furnish a steady flow of air in great quantities?

This feature you specify—it's provided in all Schramm Air Compressors, portable and stationary. Note, for instance, in the illustrated action picture, how easily Schramm is doing the job—and furnishing all the air needed!

Schramm Compressors are lightweight—compact—sturdy units, able to stand rugged and constant use. If you are not already using a Schramm Compressor, it will pay you to write for details at once.



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THE COMPRESSOR PEOPLE
**WEST CHESTER
PENNSYLVANIA**

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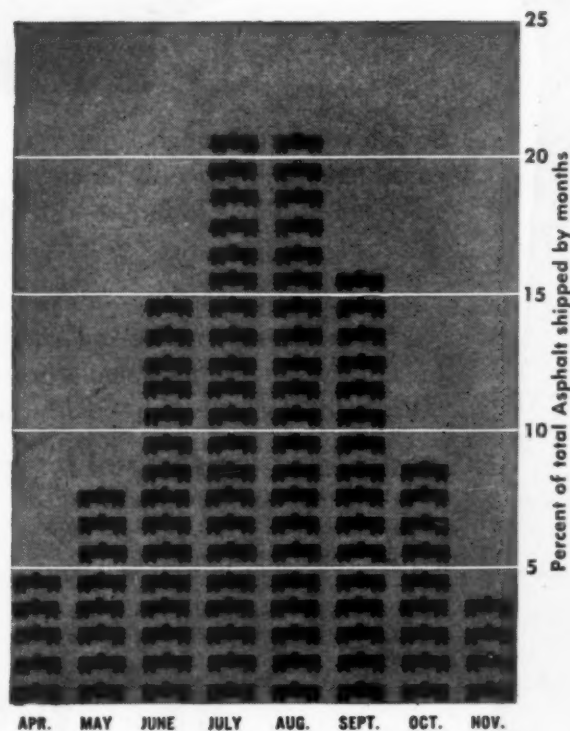
How to meet the tank car shortage and get the asphalt you need

WHETHER YOU get the asphalt you need this year for highway construction and maintenance depends almost entirely upon the tank cars that will be available for asphalt shipments after providing for other essential petroleum products for war.

One way you can help insure adequate asphalt supplies for yourself—and definitely help the war effort—is brought out by the chart above.

The chart shows the percent of total asphalt shipments made month by month *in normal times*. It also shows a rough comparison of the number of tank cars required.

Here's the catch. *These* aren't normal times. There is a limited number of tank cars available—far less than would be needed to ship normal



Percent of asphalt shipped each month during normal times and a rough comparison of the tank cars required. It is easy to see that, if shipments can be made early in the season, fewer tank cars will be needed.

requirements in the normal way. Here's what you can do. Start your work early. Order your asphalt and take delivery before the peak of the season when cars will be in greatest demand.

True, in normal times there are good reasons for waiting for the settled weather of summer. But the few days you may be delayed this year because of weather won't be nearly as great as the possible loss due to delivery delays at the season's peak because of car shortages.

This company will do everything possible to supply asphalt to its users, but here is an opportunity for you to help yourself to the asphalt you need.

Buy more War Bonds

STANDARD OIL COMPANY (INDIANA)

**STANDARD
SERVICE**

THIS SPRING **FWDs** ARE DOING
More Roadwork WITH Less Manpower



Here's a truck that needs no alibi . . . the FWD Model SU continues to make good on all-season highway work . . . it has a great performance record on road construction, maintenance, heavy-duty hauling of all sorts, snow removal and year 'round jobs.

Its well-designed, business-like appearance is consistent with its ability to go anywhere . . . to get crews, equipment and materials to any pro-

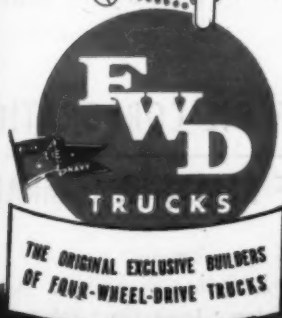
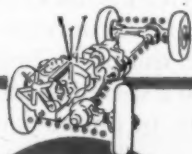
This FWD Model SU truck represents the best of 35 years of FWD leadership and experience in building four-wheel-drive trucks. Purchases of over \$75,000,000.00 worth of this model alone in less than four years show how truck buyers endorse this outstanding 5 ton FWD.

ject, off the highway or on it, in any weather, through deep mud or snow, over toughest terrain.

Phone, wire or write us, or see the nearest authorized FWD dealer, for priority data.

THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin

Canadian Factory: KITCHENER, ONTARIO



Aside from its use as a hauling unit this FWD with underbody blade, grades and maintains roads, plows snow and handles scores of other jobs in year-round service.

Road patching is just one of many routine maintenance jobs being done all over the country with rugged FWD Model SU road maintenance trucks.





F. D. Cline Construction Company, Raleigh, North Carolina, recently completed widening of this access road to a U. S. Marine Corps Air Station and a U. S. Navy Base in eastern North Carolina. Work involved grading of more than 150,000 yds. of earth and the use of more than 70,000 yds. of concrete for paving. Gulf quality lubricants and fuels helped the contractor get top performance from equipment.

GULF QUALITY PRODUCTS

and fine service help contractor make
fast time on North Carolina road job

GULF QUALITY PRODUCTS and fine service are a big help on a rush job like this," says Superintendent E. Claude Willard of F. D. Cline Construction Company, Raleigh, North Carolina. "They contribute to fewer delays in the operation and maintenance of equipment, and help insure top performance from every unit."

This access road project is one of many rush jobs where Gulf products and prompt delivery service work effectively to insure fast progress for the contractor.

Here's why so many leading contractors specify Gulf products: They have found that Gulf lubricants provide a higher degree of protection to equipment when it's pushed to the limit—and fuels of uniform quality that contribute to maximum power and effi-

ciency. Result: fewer delays, lower maintenance costs, and better all-round job efficiency.

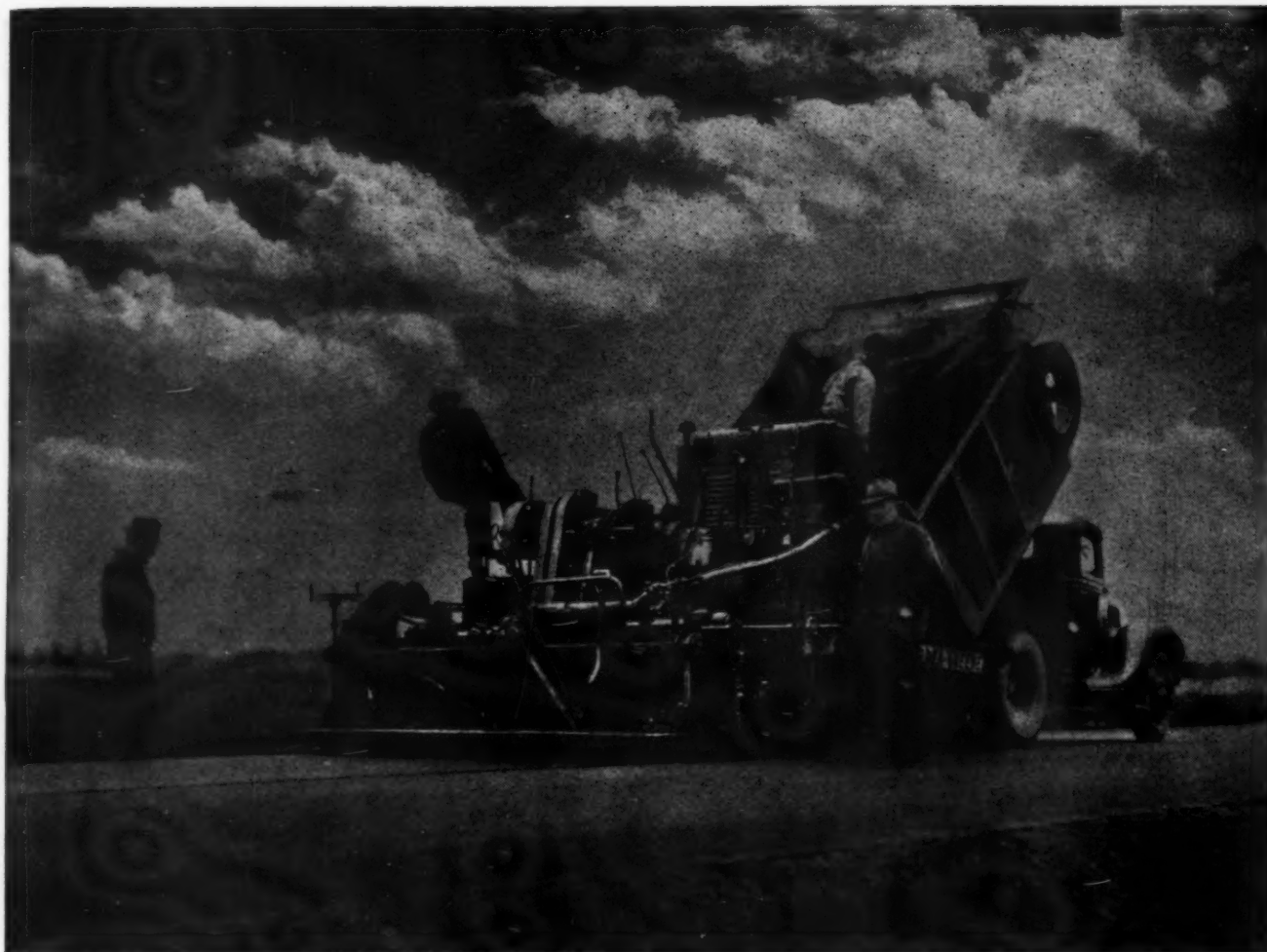
Call in a Gulf Service Engineer before you go to work on your next contract—let him show you how Gulf quality lubricants and fuels can help you do a speedier, more profitable job. Write, wire, or phone your nearest Gulf office today.



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HOW A FINISHER MAKES SMOOTHER ROADS

Here's a way to get a well packed surface without springy spots. An asphalt mat laid down with a Barber-Greene Tamping-Leveling Finisher is smooth, *firm*.

In many cases, a 5-ton roller adds only about an eighth of an inch compaction to the material *tamped* by a Barber-Greene. What's more, depressions in the base are not reflected in the finished surface. *The mat is equally packed over every variation in the subgrade.*

Hammering the hot mix 1200 times a minute, the bevelled face of the tamping bar actually compacts the material while striking it off. And to produce a mat of uniform density, the compacted mix is pushed forward and downward simultaneously.

In addition, the creeping travel of the tamper imparts a rolling movement to the loose mix in the spreading chamber. This prevents segrega-

tion of the material. And the weight of the follow-up screed — level with the stroking depth of the tamping bar — completes compaction ... leaves a smooth, table-top surface.

A Barber-Greene *Tamping-Leveling Finisher* will help you build better, smoother, lower-cost roads. Write for B-G Finisher Catalog. Barber-Greene Company, Aurora, Illinois.

The tamping bar on a Barber-Greene Finisher compacts the hot mix while striking it off. Material is pushed forward and downward at the same time to fill all the voids in an uneven subgrade. A mat of equal density throughout is produced.



Barber-Greene Constant Flow Equipment

45-4



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**A
Tough
Guy**

Built for drive and stamina, Barco Portable Gasoline Hammers excel on all kinds of rough, tough busting and drilling jobs—and cost unusually little to operate. Light in weight, this slugger packs a heavyweight punch, gives one man the strength of many. Eleven special tool attachments make Barco adaptable to any type of hammer job—the tougher the better.

Try One

BARCO Portable Gasoline Hammers

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ROBERT C. MANIX

J. T. LEWIS
GREENVILLE BITUMINOUS PRODUCTS COMPANY
GREENVILLE, OHIO
December 5, 1944

TELEPHONES
2-422
499

Littleford Bros., Inc.,
443-457 East Pearl St.,
Cincinnati, Ohio.

Gentlemen:

From the first of May until the first of November, we have applied in the State of Ohio for the State Highway, County and City Highway Departments a total of 807,000 gallons of asphalt, using a Littleford "Spray Master" Pressure Distributor.

We wish to inform you that this "Spray Master" did a remarkable job in applying this material. As you know, our Model CLAC "Spray Master" is four years old, and it has applied during that time many more times 807,000 gallons with the minimum of repairs.

Very truly yours,

Greenville Bituminous Products Co.
By *Robert C. Manix*
Robert C. Manix

807,000 GALLONS OF ASPHALT IN 6 MONTHS

The "Spray Master" Pressure Distributor finds another satisfied user because it is simple to operate and 100% efficient when building or maintaining Roads, Streets, Highways, and Airport Runways. With the Littleford Vacuum-Flow Full Circulating Spray Bar, the "Spray Master" sprays bituminous materials accurately. The spray starts and stops instantly, no dripping or dribbling on the road.

Littleford "Frameless" Constructed "Spray Master", the new feature that eliminates a trailer or truck frame, can be had in Semi-Trailer models similar to the Greenville Bituminous Products Company's unit shown here. Make your new distributor a "Spray Master".



LITTLEFORD

Littleford Bros., Inc.

454 E. Pearl St., Cincinnati 2, Ohio

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with high efficiency... low maintenance

THE CP Type T Compressor is a "wheel horse" for economical, continuous performance... keeps working away, year after year, with minimum maintenance. It is of the horizontal, single-stage, double-acting, water-cooled type, arranged for belt, direct-connected motor or steam drive. Simplate valves, liberal water jackets, one-piece

trouble-free crosshead, double-row tapered roller main bearings are a few of the features responsible for its superior performance. Type T Compressors are available in sizes from 15 to 125 hp, in single-stage design for pressures up to 150 pounds, and in multi-stage units for pressures up to 5,000 pounds. Write for Bulletin 728.

★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL  COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

the
90% — Placing 600,000 sq. yd.
of black top pavement
in 80 working days

*L*AYING the binder and top courses on twenty-five miles of two-lane roads and a lesser mileage of secondary roads in one of the new naval training stations is another of the rush jobs completed in record time by Adnun Black Top Pavers.

These machines showed their dependability by staying on the job 10 hours a day, seven days a week until the first part of the pavement had been completed and then to speed up construction, the day was lengthened to 12 hours. Here, too, was a typical example of their versatility—each machine laying either the thick binder course or the thin top course with the width and depth controlled to meet every specification. Continuous course correction, an exclusive feature of Adnuns, automatically corrected hollows and bumps with each successive course, reducing all irregularities to insignificance. With an Adnun you can build highways and airports with the minimum of subgrade preparation, with tight joints between strips, maximum density, smoothest finished surface and all-weather durability. Write today for details or see your Foote distributor.

the Equipment
**FOUR ADNUN
BLACK TOP PAVERS**

THE FOOTE CO., INC.
1936 State Street
NUNDA, N. Y.



ADNUN
TRADE MARK REGISTERED

BLACK TOP PAVER

WITH CONTINUOUS COURSE CORRECTION



FROST BOLLS?



fix 'em quickly
WITH
CLEVELAND
Paving Breakers

*Speed Final Victory!
Buy More War Bonds*

CLEVALOY CHISELS, MOILS, TOOLS



Moil Narrow Wide Digging Sheeting 7" Tamper 3" Tamper Clay Clay Asphalt
Chisel Chisel Blade Driver Bar Bar Blade Spade Cutter



C7

With the advent of spring thaws, you will need Cleveland Paving Breakers for emergency calls and hurry-up repair work.

Model C7 is best for the average job. It is an 80 lb. slugger, easy to hold. Two C7's can be run from a Number 85 compressor. For heavier work, try the C9, which is two pounds heavier but uses no more air. It is designed for breaking the hardest, reinforced concrete. For lighter work, trimming, etc., use the smaller C10, three of which operate from a Number 85 compressor.

Also be sure to select the proper chisels, moils, etc., from the "Clevaloy" line illustrated here. Bulletin 128 tells all about these Cleveland tools, and also contains many valuable hints on getting better service from your paving breakers . . . *Write for it!*

LEADERS IN DRILLING EQUIPMENT

**THE CLEVELAND
ROCK DRILL CO.**

DIVISION OF THE CLEVELAND PNEUMATIC TOOL COMPANY
CABLE ADDRESS: "ROCKDRILL" • CLEVELAND 5, OHIO

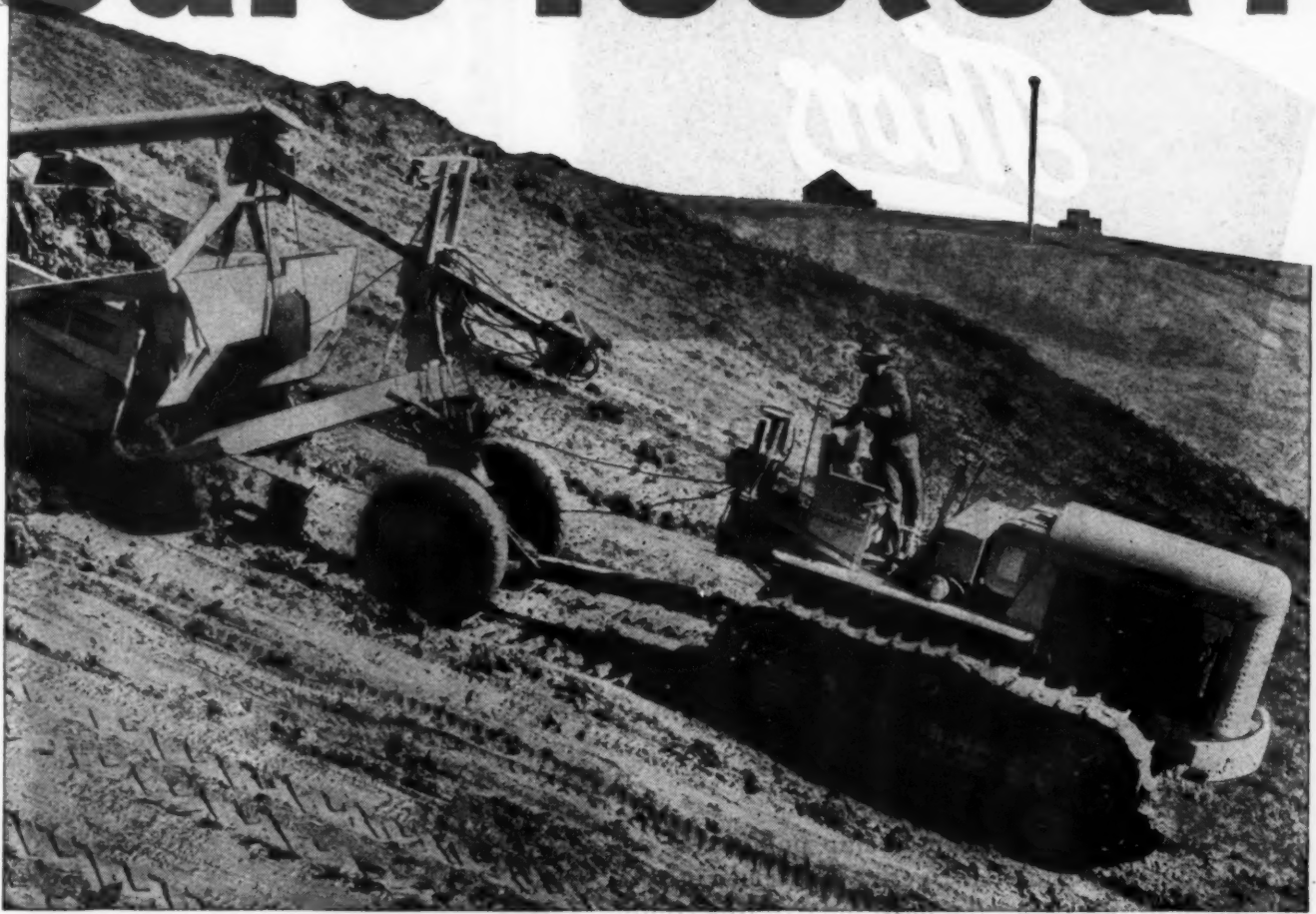
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CANADIAN DISTRIBUTORS

Purves K. Ritchie & Son, Ltd., 656 Hornby Street, Vancouver, B. C.

Sure-footed!



● Downhill or up . . . turns or straightaway, Oliver "Cletrac" crawler tractors have a sure-footed grip. Even when taking a heavy load downhill, they don't zigzag. Power is never disconnected from either track . . . both tracks keep working all the time to assure perfect control, even on turns.

This sure-footed grip, which assures greater safety on hills and turns, is found only on Oliver "Cletracs." For only Oliver "Cletrac" gives you *controlled differential steering* . . . the exclusive feature that eliminates "declutching" or "braking" on turns . . . that enables Oliver "Cletracs" with a heavy load to steer the same going downhill as up.

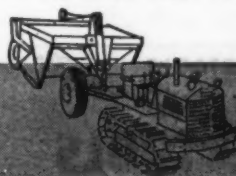
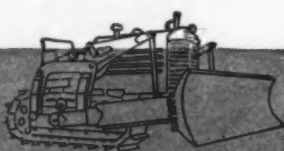
There is no need for the operator to "cross over" on the controls and steer in the opposite direction as is necessary on the ordinary tractor.

These sure-footed tractors are unusually accessible, making maintenance a simple task. They are ruggedly built for long life and greater resistance to the shocks, strains and twists of tractor service.

Substantial numbers of Oliver "Cletrac" tractors are now being released for essential use. Your Cletrac dealer will gladly assist you in making application for a new tractor. • **The OLIVER Corporation**, Industrial Division: 19300 Euclid Avenue, Cleveland, Ohio.



OLIVER - Cletrac



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Automatically Lubricated

Thor SUMP PUMPS

KEEP YOUR JOBS IN THE DRY

Thor automatically lubricated sump pumps are designed and manufactured to operate most efficiently on the toughest jobs under the most unfavorable conditions. The Thor rotary air motor is enclosed in an airtight, foolproof housing to assure steady operation whether partially or fully submerged. Because of their self-priming, centrifugal impeller type construction, Thor sump pumps will operate in the dirtiest of water—in oil—in sludge or in sewerage, at peak efficiency. For the best in sump pumps call your nearby Thor distributor today.

INDEPENDENT PNEUMATIC TOOL CO.

600 W. Jackson Boulevard, Chicago 6, Illinois

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SINKER ROCK
DRILLS

STOPPER ROCK
DRILLS

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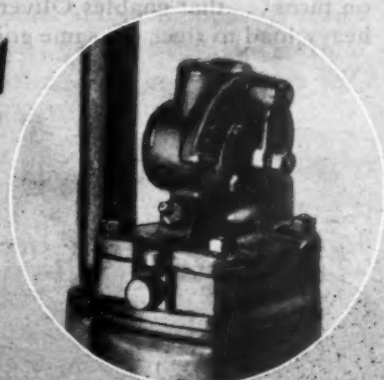
EASY TO CARRY!

AUTOMATIC LUBRICATION

Thor pumps are equipped with a highly efficient automatic lubrication system. The oil is fed from a built-in oil reservoir to the rotor blades and the cylinder bushings in a fine continuous spray. Live air pressure provides continuous application of grease to the impeller hub and bushing.

VARIABLE SPEED CONTROL

The Thor variable speed throttle accurately controls the speed and capacity of the pump. This is a hand lever that can be set to pump up to 244 gallons per minute at 90 lbs. air pressure, or to idling speed where it pumps slowly.



Digging for a Lost Highway



with the new Bros Rotary Plow

●They said—"It couldn't happen here"—yet hundreds of streets, highways and roads were actually lost for weeks in the January and February snow storms.

Yes, "it did happen here" and it can happen again. But many cities, counties and states will be ready—for they have found quick snow removal is a necessity when the snow storms come. They have also found—The New Bros Rotary Plow—the answer for quick, economical snow removal—

because its exclusive "snow rake and controlled snow placement" makes it the only rotary of its kind.

It will work in the deepest of snow faster and more economically than any other rotary plow. It can be easily attached to any heavy duty truck. Back of these statements are hundreds of Bros Plows serving cities, counties and states on highways, streets and airports—that give proof, "you get the most with a 'Bros'". Get your orders in now—for the New Bros Rotary Plow.

BROS *Sno-Flyer* **ROTARY PLOW**

WM. BROS BOILER & MFG. COMPANY • MINNEAPOLIS 14, MINNESOTA
MANUFACTURERS OF ROAD EQUIPMENT

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→ **ROADS AND STREETS, April, 1945**

WHEN "BIG BOY" TAKES OFF HIS UNIFORM



● All over the world, where the going is toughest, the M1A1 Army heavy wrecker has earned its reputation as the biggest, toughest, pullin'-est bruiser on wheels. These super trucks, built by Ward LaFrance Truck Division for the Ordnance Department, are used for such jobs as tank recovery, motor vehicle rescue, lifting and carrying disabled bombers. They operate in the mire of European swamps . . . the muck

of Asiatic jungles. To the M1A1 wrecker, a road is a convenience, rather than a necessity . . . In the near future, Ward LaFrance commercial trucks and tractors will again appear on America's highways. These Ward LaFrance over-the-road trucks and tractors are designed to haul pay loads faster and more economically than ever before. They are not streamlined like a sport coupe, but they look like what they are: the biggest, toughest, sturdiest motor trucks on the highway. They are backed by the twenty-five year Ward LaFrance reputation for building great trucks, further proved by unbeatable performance all over the world.

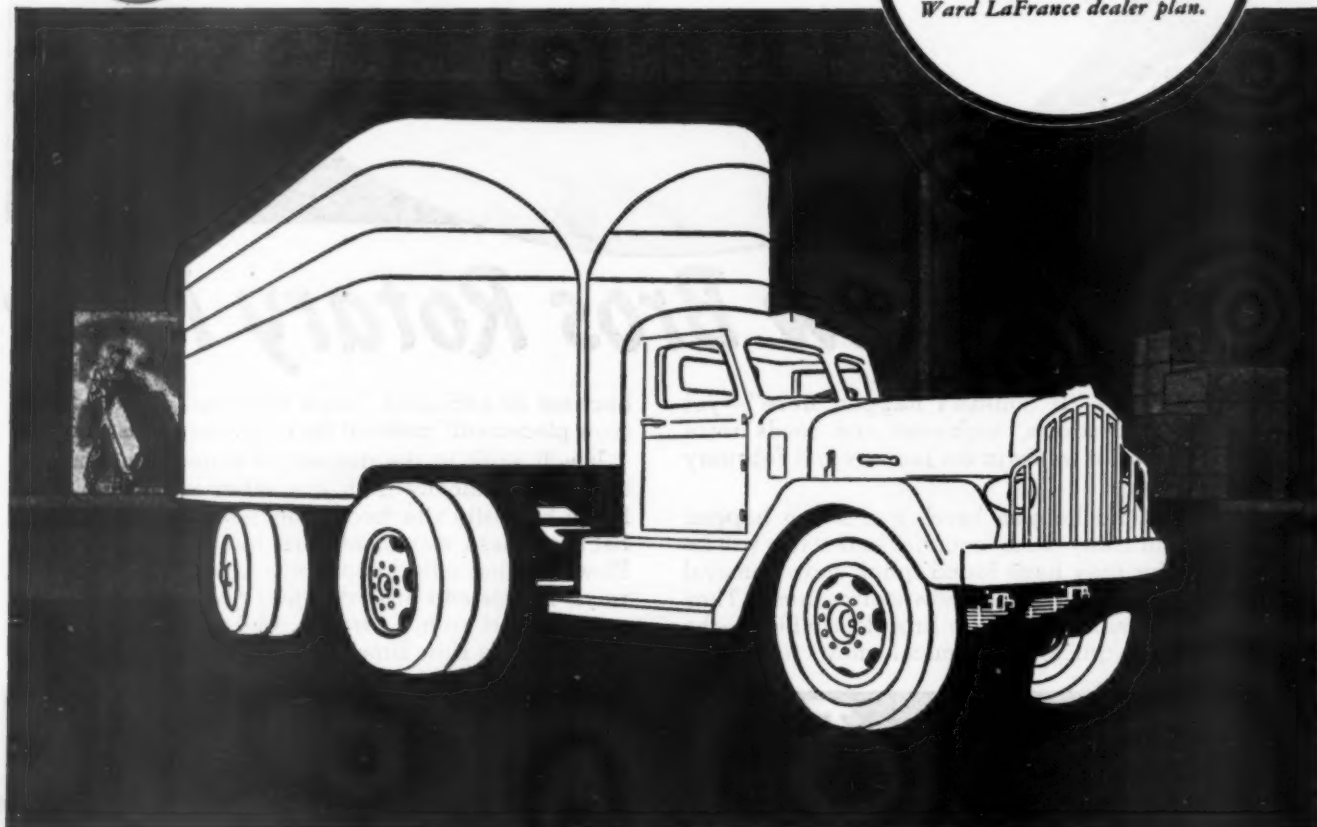
WARD LAFRANCE

TRUCK DIVISION

GREAT AMERICAN INDUSTRIES, INC.
ELMIRA • NEW YORK



FRANCHISES ARE AVAILABLE
to alert dealers in a number
of attractive territories. Lead-
ing dealers now handling small-
er, non-competitive trucks will
be especially interested in the
Ward LaFrance dealer plan.




H

Model H Cummins Diesels, 4 $\frac{1}{2}$ " x 6", four or six cylinders, develop their maximum 100 and 150 hp., respectively, at 1800 rpm. Designed for—and proved in—various types of wheel and track-mounted equipment and stationary applications.

NH

Series NH-600 and NHS-600 (supercharged) Cummins Diesels, 5 $\frac{1}{2}$ " x 6", develop maximum 200 and 275 hp., respectively, at 2100 rpm. Both are six-cylinder, dual valve engines... similar in design, weight and dimensions to the Model H. Automotive and industrial models.

L

Model L Cummins Diesel, 7" x 10", six cylinders, develops maximum 250 hp. at 1000 rpm. This heavy-duty, medium speed engine is designed for shovels, draglines, cranes, locomotives, etc., and for stationary applications and generating service.

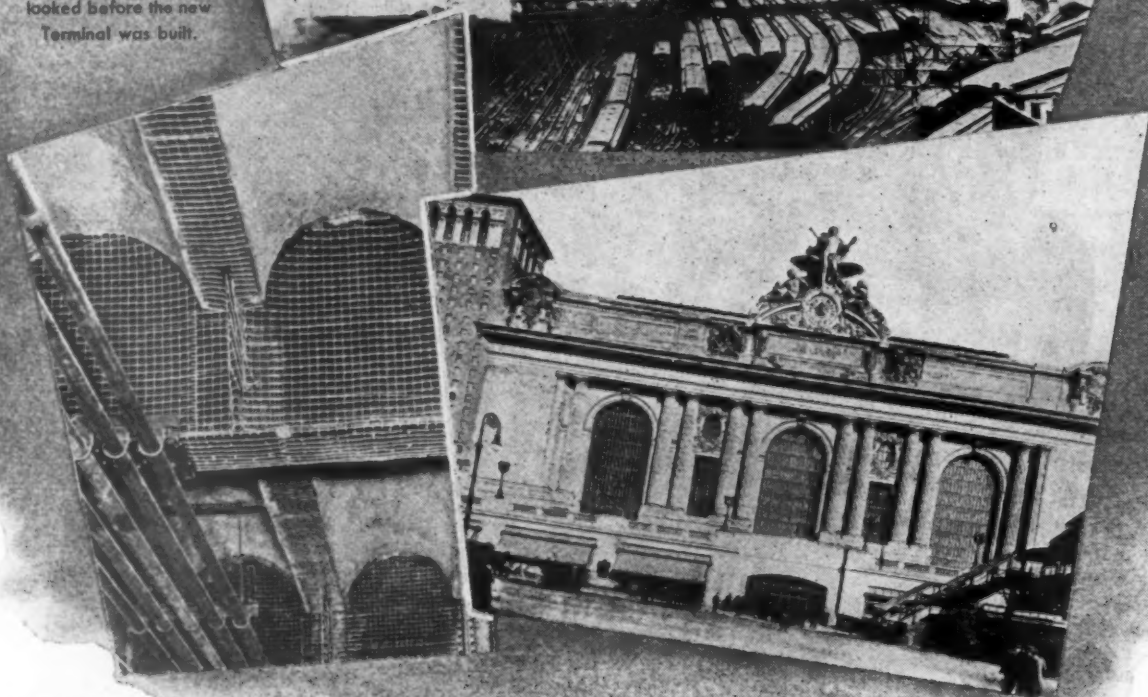
Read the record! The record of Cummins Dependable Diesels in trucks, shovels, compressors, rock crushers, dredges and many other types of heavy-duty construction and material handling equipment. Read that record and you will find proof that Cummins-powered means "powered for profit."

CUMMINS ENGINE CO., INC., Columbus, Ind.

CUMMINS
Dependable
DIESELS

SINCE 1918...PIONEER OF PROFITABLE POWER
THROUGH HIGH-SPEED DIESELS

Grand Central as it
looked before the new
Terminal was built.



How Clinton Welded Fabric was used for wrapping
of structural steel.

Grand Central Terminal as it looked in 1913.

How a transportation problem was blasted out of old New York

By the turn of the century the old Grand Central Station could no longer accommodate New York's traffic. Expansion was essential—but realty values were high, so they decided to build 67 tracks on two levels. This necessitated the blasting and removal of over 3 million cubic yards of rock—of building a structure that would stand vibration, and the tremendous weight of Park Avenue's hotels and apartments.

In the building of Grand Central Terminal 1,300,000 sq. ft. of Clinton Electrically Welded Fabric were used for wrapping beams, girders and steel substructure. And ever since 1902,

when Clinton Welded Fabric was invented, this strong, uniform fabric has been used in the reinforcement of thousands of buildings, bridges, sewers and streets.

Clinton Welded Fabric is characterized by perfect wire and welds, high uniform tensile strength, and freedom from ties and clips. It is available in a wide range of styles, both in gauge and spacing. It comes in sheets or rolls cut to your exact specifications, thus saving time and expense on the job. On your next concrete reinforcement job specify Clinton Fabric—the choice of many leading contractors and engineers.

WICKWIRE SPENCER STEEL

500 FIFTH AVENUE, NEW YORK (18), N. Y.

ABILENE • BOSTON • BUFFALO • CHATTANOOGA • CHICAGO • CLINTON (MASS.) • DETROIT • HOUSTON • LOS ANGELES



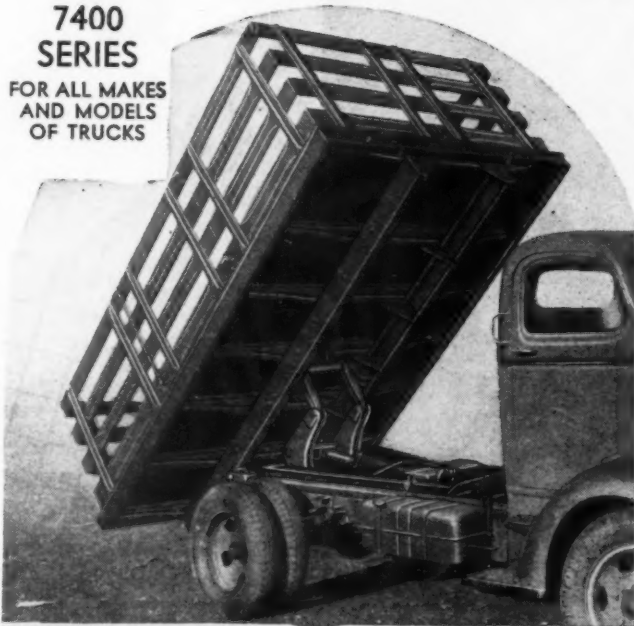
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PERFECTION STAKE BODIES and HOISTS

7400
SERIES
FOR ALL MAKES
AND MODELS
OF TRUCKS



Compare these FEATURES

1. Rolled edge, pressed steel side and end rails for increased strength and rigidity.
2. Tapered bolsters—pressed channel section—for better wheel clearance and lower mounting height.
3. Adjustable pressed steel sills for easier installation on various chassis widths.
4. Entire understructure arc-welded to form a flexible but rugged and durable sub-frame.
5. Super-reinforced 12-gauge steel stakes for utmost strength.
6. Oversize hydraulic hoist with cushion-drop mechanism—speedy, powerful, dependable. Double pusher arms prevent sway.

Write for Bulletin and Prices

THE PERFECTION STEEL BODY CO.
GALION, OHIO



PERFECTION
TRUCK BODIES AND HOISTS

LAYS SMOOTHER PAVEMENTS

the first Bituminous Paver
with **AUTOMATIC LEVELING,**
CONTROLLED COMPACTION
and **FINISH TO**
SUIT MATERIAL



AUTOMATIC SELF-LEVELING

Besides the "long wheelbase" effect obtained by floating runners with lever-type drawbars which support the screed, the screed is positively held to grade by electrically connected pans, operating on laid surface, curb or header, which correct variations as slight as 15/1000 inch.

UNIFORM COMPACTION

Modern High-Speed Oscillating Compactor crowds and works material into low spots with a uniform pressure impossible with old-fashioned tampers. Cuts off clean.

NO WEIGHT ON THE SOFT SURFACE, TILTABLE SCREED GIVES ANY FINISH

For 14 years Jaeger alone has kept all weight and traction on the subgrade. No premature sealing or displacement of new-laid material. Now, with 2-way tiltable screed, finish can be varied from the most open, fluffy surface to the densest sheet asphalt. Ask for Specification BPL-4. It gives full details.

JAEGER SPREADER-FINISHER "TEAM" for Concrete Airports, Highways



THE JAEGER MACHINE COMPANY
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JAEGER
Engineered **EQUIPMENT**

"Sure Prime" Pumps, "Speedline" Mixers, "Air Plus" Compressors,
"Fleet-Foot" Loaders, Jaeger Hoists, Spreaders and Finishers

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**This tough elastic waterproof film
cures concrete faster, more efficiently
"CECURE COMPOUND"**

That drum he's lifting off the truck holds 55 gallons of CECURE compound. A watertight film sprayed immediately on newly laid concrete that cures faster and better than old-fashioned waterproof paper, cotton mats, burlap, straw, dirt or "ponding". Saves time, money, and hours of work!

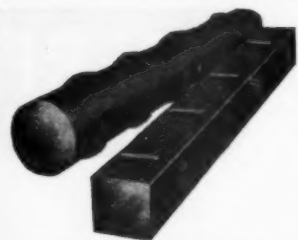
It's part of the complete Ceco service to builders of concrete highways. A service that starts with trained-in-the-field engineering assistance, and includes all the reinforcing steel and accessories needed in highway construction.

You'll find a Ceco headquarters nearby, staffed with competent engineers, and with a warehouse providing "when you need it delivery". Take advantage of Ceco's 30 years of experience in reinforced concrete construction . . . find out now how Ceco's complete service enables you to build better at lower cost!

CECO STEEL PRODUCTS CORPORATION

HIGHWAY PRODUCTS DIVISION—5701 West 56th Street, Chicago, Illinois

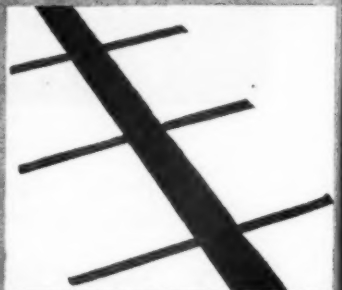
Manufacturing Division, Concrete Engineering Division, Sheet Steel and Wire Division



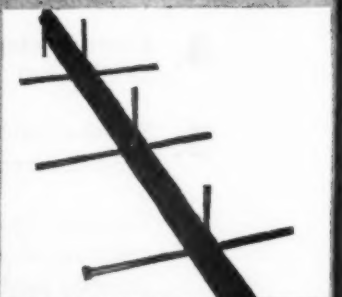
CECO Reinforcing Bars: rolled from new billet steel and are furnished both as plain rounds and as deformed rounds and squares.



CECO Welded Fabric: A square or rectangular mesh made from cold drawn steel electrically welded at the intersections of the transverse and longitudinal wires. Specially adapted for use in reinforcing roads and pavements.



CECO Expansion Joint: is elastic, compressible, durable and waterproof. It relieves the stress and assures long life and a first class job. Furnish both fibre and asphalt expansion joint.



CECO Contraction Road Strip: provides a positive crack (either central or transverse) to prevent irregular cracks with the contracting or expanding of the slab.

ENGINEERING

MAKES THE BIG DIFFERENCE IN

CECO

CONSTRUCTION PRODUCTS

Yes-They Go Together!



Made exclusively for Allis-Chalmers tractors. They go together!

The New

BAKER

*Cable Controlled
Bulldozer and
Gradebuilder and
Allis-Chalmers Tractors*



Baker, the greatest name in Hydraulic Bulldozers, announces the new Baker Line of Cable Controlled Bulldozers and Gradebuilders. Designed with the full cooperation of Allis-Chalmers and Baker engineers and thoroughly tried and field tested under their joint supervision, here's more evidence that Baker Equipment and Allis-Chalmers Tractors "go together."

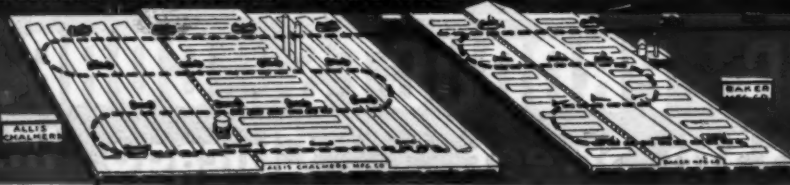
Features include • 5-position tilting blade on both bulldozers and gradebuilders • "Air-conditioned" cone clutches and differential or self-energizing brakes with all adjustments within easy reach • Rugged tubular steel superstructure • Double and single drum power control units for use on rear, and single drum for use on front power take-off. Available as separate units • Simple to operate and maintain, sturdy construction, well-balanced, minimum weight. Send for literature.

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506 Stanford Ave., Springfield, Illinois



"STRAIGHT THROUGH" ASSEMBLY LINE - ALLIS-CHALMERS TO BAKER TO YOU!



The modern Baker plant with its completely equipped fabricating, machining and blacksmithing shops adjoins the Allis-Chalmers crawler tractor plant. When you order an A-C tractor with Baker bulldozer or gradebuilder, your tractor leaves the A-C assembly line, crosses a narrow court and goes on the Baker final assembly line.

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Para-Plastic
HOT-POURED
RUBBER SEAL

MANUFACTURERS of

PREMOULDED EXPANSION JOINTS; FELT-SIDED ASPHALT JOINTS; SELF-EXPANDING CORK JOINTS; FELT SIDED AND CORK JOINTS; FIBER JOINTS...

Concrete Slabs in
Normal Temperatures

Para-Plastic Firmly
Bonded to Concrete
During Sub-Freezing
Temperatures

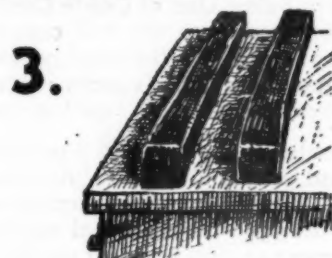
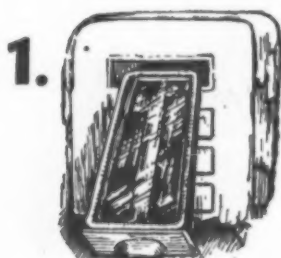
ASPHALT PLANK for—
INDUSTRIAL FLOORING;
BRIDGES AND BY-PASSES,
RAILROAD TRACK FILLER,
ETC.; ETC.; ETC.

— *Para-Plastic* —
EXPANSION JOINT SEAL
EXTENDABLE—MAINTAINS
BOND at 0° F.



HIGHWAY DRIVING IS A REAL
PLEASURE ON CONCRETE ROADS

MADE SAFE and SMOOTH with *Para-Plastic* EXPANSION JOINTS



THREE TESTS: PROVING PLIABILITY OF *Para-Plastic* IN COLD WEATHER

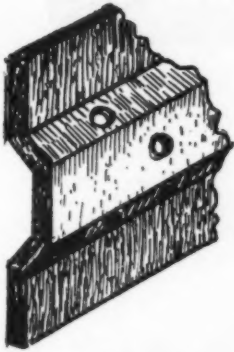


- 1 — PARA-PLASTIC Compound Frozen in Solid ICE.
- 2 — Still PLIABLE, easily BENT or TWISTED.
- 3 — In few Minutes—RESUMES Normal SHAPE.

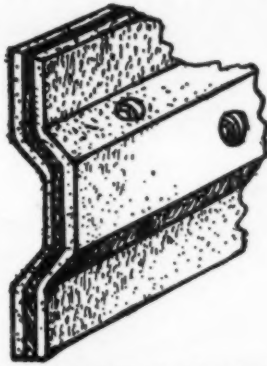
SERVICISED PRODUCTS CORP.
6051 West 65th Street, Chicago, Ill.

SERVICISED: CONTRACTION JOINTS AND DUMMY JOINTS

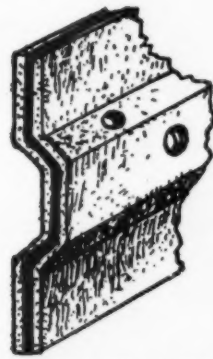
PATENT No. 2,370,153. OTHER PATENTS PENDING.



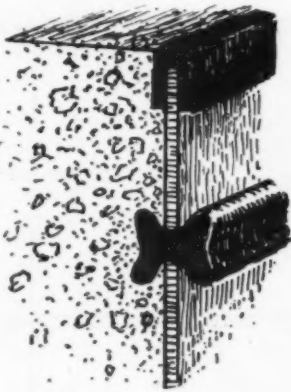
A rigid mastic joint with waterproofing paper sides, punched for dowels and staking. Also prepared with Para-Plastic for better waterproofing of the crevice.



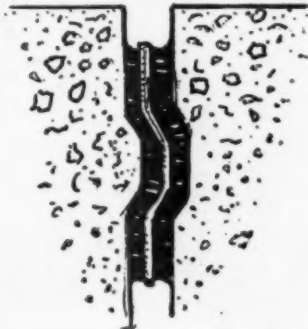
A wood veneer core for interlocking of slabs having felt sides cemented thereto with Para-Plastic which upon oozing will waterproof the top and bottom of the center strip.



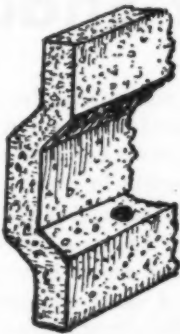
Light steel center strip faced on either side with Para-Plastic and felt sides. Sufficient coverage of material to cause slight oozing above and below the plate in order to cause the Para-Plastic to adhere to the walls of the concrete and waterproof the space above and below the joint.



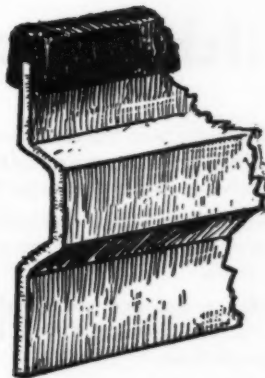
Special keying device formed of Para-Plastic mounted in place by rigid board and capped with Para-Plastic crown.



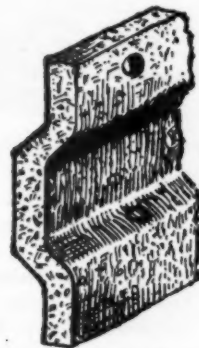
Steel center strip coated with Para-Plastic prior to laying in cement. Absolutely waterproofing the crevice in case of contraction.



Asbestos cement tongue-and-groove strip prepared from the same material from which asbestos shingles are formed. Can be water-proofed or not as desired.



Economical steel center strip having less steel than ordinary. The top ridge having mounted thereon a Para-Plastic crown.



Center strip formed and pressed from sawdust, having synthetic resin binder. Can be water-proofed if desired.

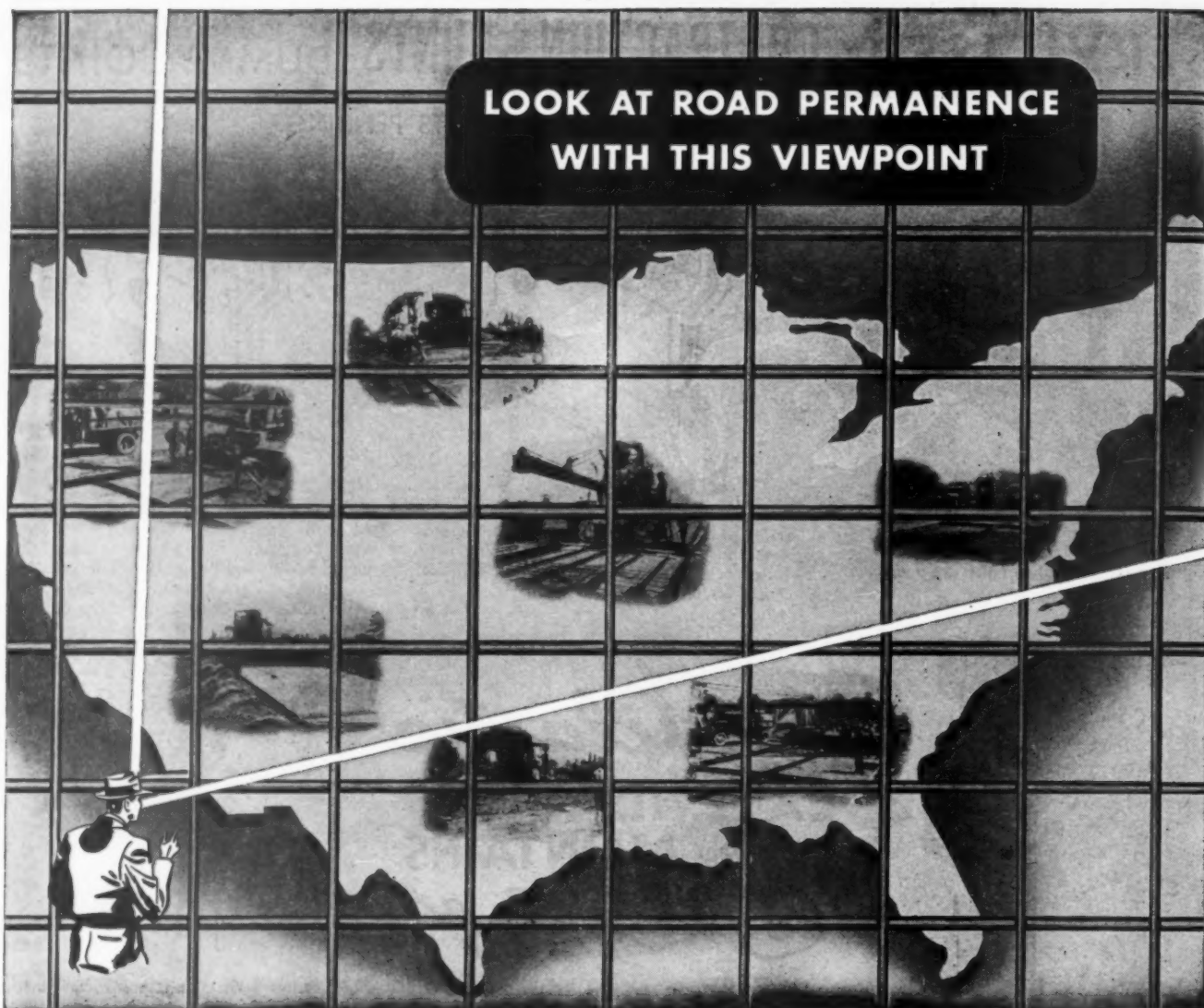


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ALL OVER THE MAP—TRUSCON WELDED STEEL FABRIC IS PROVING THAT

***Steel* Builds Roads that Endure!**

Steel and concrete have proved their special worth in millions of miles of highways. At every point of the compass . . . under every conceivable condition of weather . . . Truscon Welded Steel Fabric Reinforcement, and other specialized Truscon roadbuilding products, are assuring long-life concrete pavements.

Engineers and designers have found by experience, practice and research that the following advantages can be expected from Truscon Welded Steel Fabric Reinforcement:

Provides resistance to cracking due to shrinkage of concrete during setting period.

Provides tensile strength necessary

to resist subgrade friction caused by expansion and contraction of the concrete slab due to temperature changes.

Provides increased resistance to cracking of concrete due to warping under load.

Provides resistance to the development of microscopic cracks into visible cracks.

Provides resistance to cracks opening and allowing the entrance of water.

Provides resistance to broken ends of slabs separating at a crack.

Decreases spalling and progressive disintegration of the concrete.

When you plan roads, plan them well. Use structural designs that have been proved the most economical, durable and serviceable in the *long run*. Use Truscon Welded Steel Fabric with other associated Truscon roadbuilding products, and assure lasting prestige for you and more permanent highways for the communities you serve.



TRUSCON

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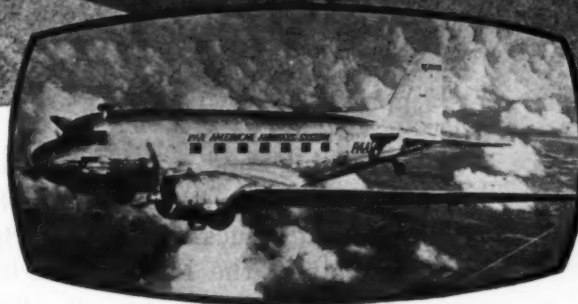
SUBSIDIARY OF REPUBLIC STEEL CORPORATION

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... for Pan American



PAA AIRWAYS SYSTEM PHOTOGRAPHS



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HUBER ROLLERS

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How a Bucket Loader Can Save Money *the Year 'Round*

Truck loading time is cut to a minimum by the continuous operation of a Barber-Greene Bucket Loader. But more than that, the B-G Loader has year-round utility . . . can hustle along some construction or maintenance job each season.

★ The B-G Loader yields higher yardage, with less power, less weight, and less cost than any other method.

★ It can effectively handle a variety of loose materials—soil, sand, cinders, gravel or roadway debris.

★ Clean pick-up is assured with the fol-

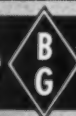
low-up scraper that cuts to grade and does light excavating.

★ Top performance in stockpile or semi-compacted natural deposit loading, light excavating, shoulder shaping or stripping to grade can be maintained with the 12 selective crowding speeds.

★ By substituting a B-G Snow Loader boom, the B-G Loader can be used for street snow removal.

Ask your B-G representative for details on the versatility and economy of B-G Bucket Loaders. Barber-Greene Company, Aurora, Illinois.

Barber-Greene

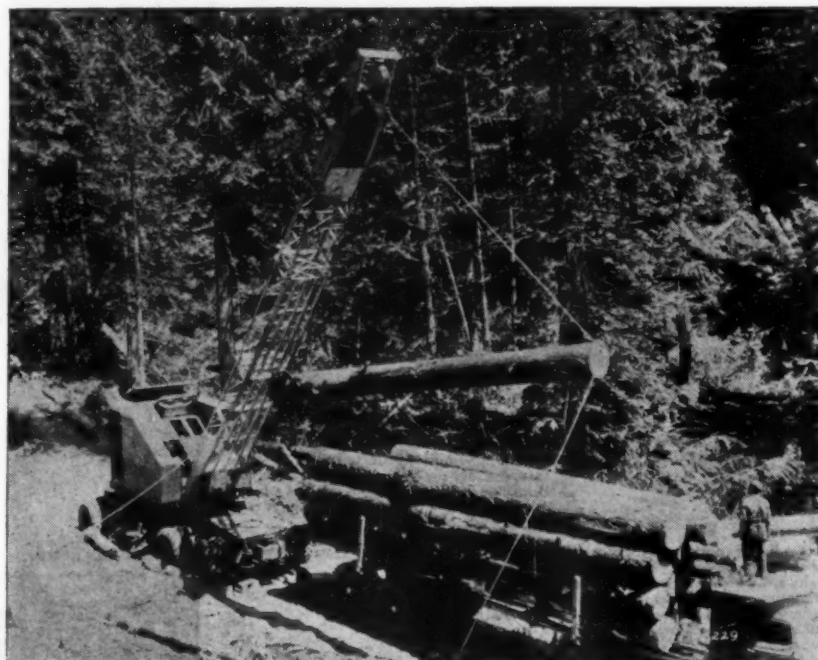


Constant Flow Equipment



Cut Material-handling Costs with this NEW CLUTCH

Shovels, cranes, hoists and draglines, equipped with the Fawick Airflex Clutch, are more dependable, more productive machines. They are free from the troubles of conventional clutches, with their resulting idle time and added costs.



The FAWICK Airflex Clutch

...saves TIME, space, maintenance and repairs. It has no arms, toggles or springs—needs no lubrication or adjustments—controls power and torque by air—absorbs shocks and vibration.

Proved by the Navy under battle conditions and on heavy-duty drives throughout industry.

Fawick Engineering Department will gladly give you recommendations and further details.

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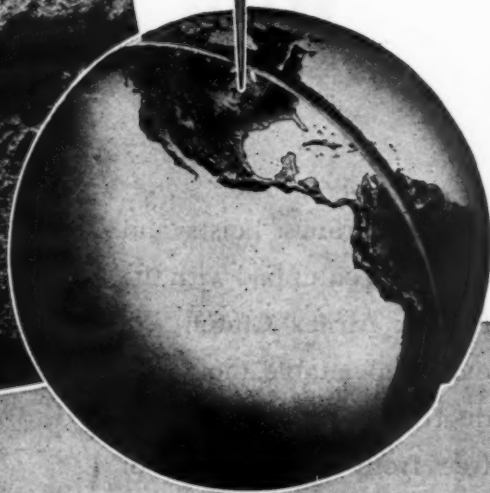
In Britain, Crofts Engineers, Ltd., Bradford, England

FAWICK *Airflex* CLUTCH

POWER CONTROLLED BY AIR

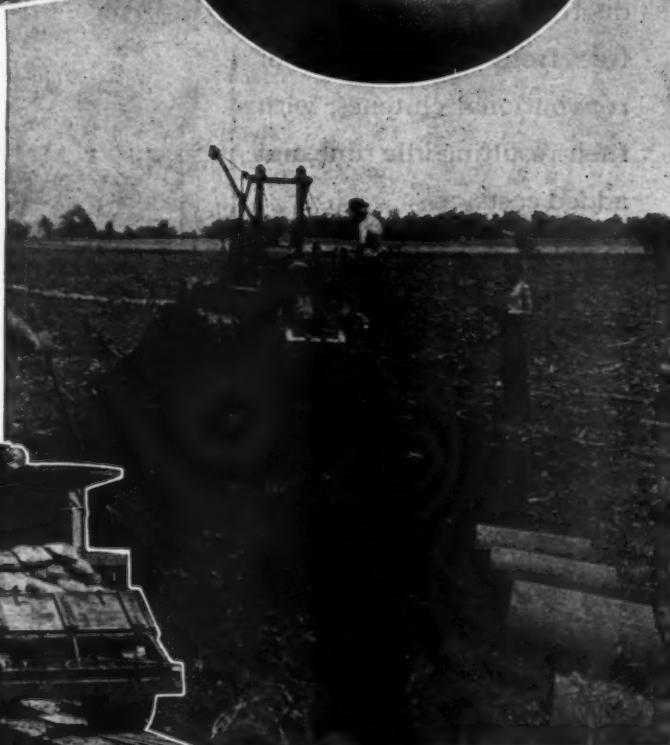
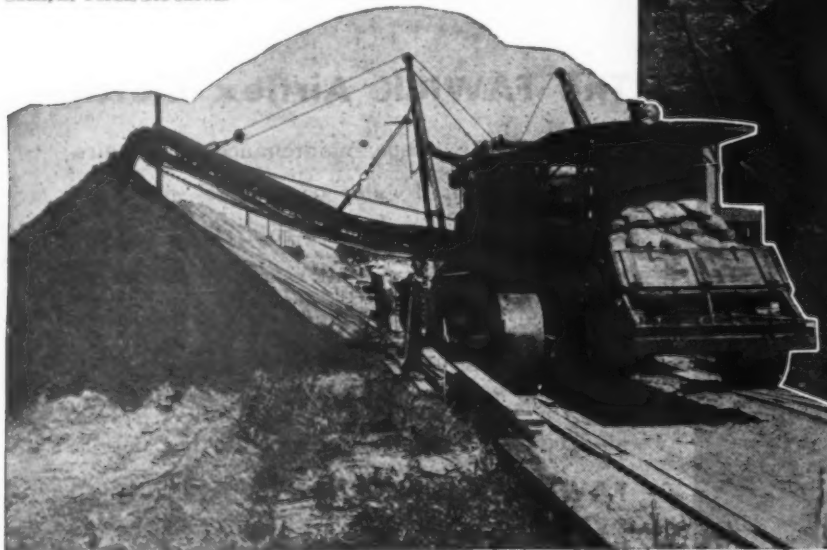
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**Better Living Conditions
Demand
More Trenching!**



Better living conditions mean more and better sanitation, running water, more gas, electricity and telephones that all call for trenching—millions of miles of it—dug fast and at low cost—and that calls for Buckeyes. Model 410 shown—is one of over a dozen models; ladder and rotary-digging wheel type.

Better living conditions for more people, for which we are now fighting, call for new airports and highways which will require proper drainage, new irrigation projects and aqueducts to bring ample water supplies to cities in need—as in the past, Buckeye trenchers will be available to dig the trench at minimum cost—more and better Buckeyes. Model 260 shown.



Today, and for a long time to come, as a nation we have millions of market baskets to fill, here and abroad. Buckeyes—the original and still the most widely preferred power trench digging machines—are even now aiding food production through reclamation drainage of lowlands and through soil conservation tiling. Model 1 shown.

**If you are looking ahead —
send for Trencher Catalog.**

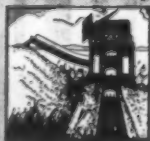


Built by Buckeye

Buckeye Traction Ditcher Co., Findlay, Ohio



Convertible Shovels



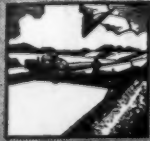
Trenchers



Tractor Equipment



Road Wideners



P.T. Trenchers



Spreaders



This Heil unit picks up heaped 15-yard loads like this one — in 40 to 50 seconds.



You can travel to the fill at speeds up to 20 M.P.H. 5-speed transmission gives you easy shifting, fast acceleration.



This Heil unit spreads load evenly and quickly by means of a positive, mechanical tilting-floor push-out action.

HEIL Hi-Speed Cable Scoops

give you fast, profitable dirt-moving at low cost

Here is a perfectly matched, high-speed dirt-moving unit that consists of a 150 H.P. Heil Rubber-Tired Tractor and a 15-yard Heil Cable-Operated Scoop. It combines proved efficiency with speed, economy, and flexibility—to help you move more yardage faster and cheaper.

These units have been thoroughly job-tested on a variety of earth-moving projects and under all types of operating conditions. Experience proves that: (1) You get fast acceleration even with heaping loads. (2) You cut round-trip time and secure top operating efficiency, particularly on long hauls. (3) You get a fast, positive discharge by a leverage action that exerts a *low line-pull* on the unloading cable.

These are a few of the reasons why Heil Hi-Speed Cable Scoops have gained such widespread acceptance throughout the dirt-moving industry. You can profit by the example of other successful dirt movers by adding these efficient Heil units to your equipment. Write for bulletins or —

SEE YOUR INTERNATIONAL TRACTOR DISTRIBUTOR

R-46



THE HEIL CO.

GENERAL OFFICES • MILWAUKEE 1, WISCONSIN

Old man winter's **fox-holes**

Old Man Winter digs his foxholes on your highway. Many Highway Departments have declared the past winter the worst in history. "Fox-holes" dot highways and streets all over the nation.

Manpower and material restrictions may make it difficult to undertake major construction projects, and

that makes immediate and adequate repair and maintenance so much more important than ever.

Tarmac is ideal for either patching or surface treatments, because of its property of forming a firm bond to the existing surfaces. Let us send you Tarmac specifications for your particular highway problem.



KOPPERS COMPANY, INC.

Tar and Chemical Division • Pittsburgh 19, Pa.



• to see why you get
hot, dry steam faster
with less fuel and water

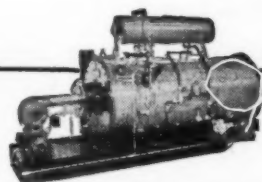
● The cross-section illustration graphically shows the famous Cleaver-Brooks four-pass down-draft construction which, with integral oil-burner, accounts for the remarkable efficiency of Cleaver-Brooks steam generating equipment.

This construction doubles the lineal gas travel, compared to ordinary two-pass boilers,—the result is unmatched high heat transfer and efficiency.

No other equipment has this original and exclusive four-pass down-draft construction—plus the perfected positive dry coil method of condensate return—that's why you get hot, dry steam faster with less fuel and water with Cleaver-Brooks equipment. Write for bulletins and complete information.

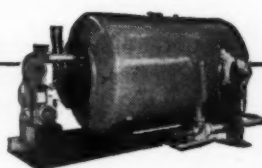
CLEAVER-BROOKS COMPANY

5106 N. 33rd Street • Milwaukee 9, Wisconsin



Automatic Steam Plants

Completely self contained; highly efficient; require only simple piping connections to place in operation. Fully automatic fuel-oil burner; condensate recovery and feed water pumping system; no stack needed, sizes from 20 to 500 h.p.; pressures 15 to 200 lbs.



Hot Water Boosters

Oil-fired; fully automatic or manual operation; no licensed engineer needed; two capacity sizes: 3000 gals. storage tank for 1600 gals. of water heated 150° F. per hour; 1500 gals. storage tank for 800 gals. of water heated 150° F. per hour.



Portable Pumping Boosters

Heats bituminous material by direct firing in one operation, loading directly to distributor, relay truck or returning to tank car. Two sizes, truck mounting or 4-wheel trailer.



Portable Tank-Car Heaters

Available in 2 and 3 tank-car sizes. Oil-fired with exclusive four-pass flue travel; dry-coil steam condensate return under pressure — no water or heat loss. Provides a portable source of steam wherever needed.

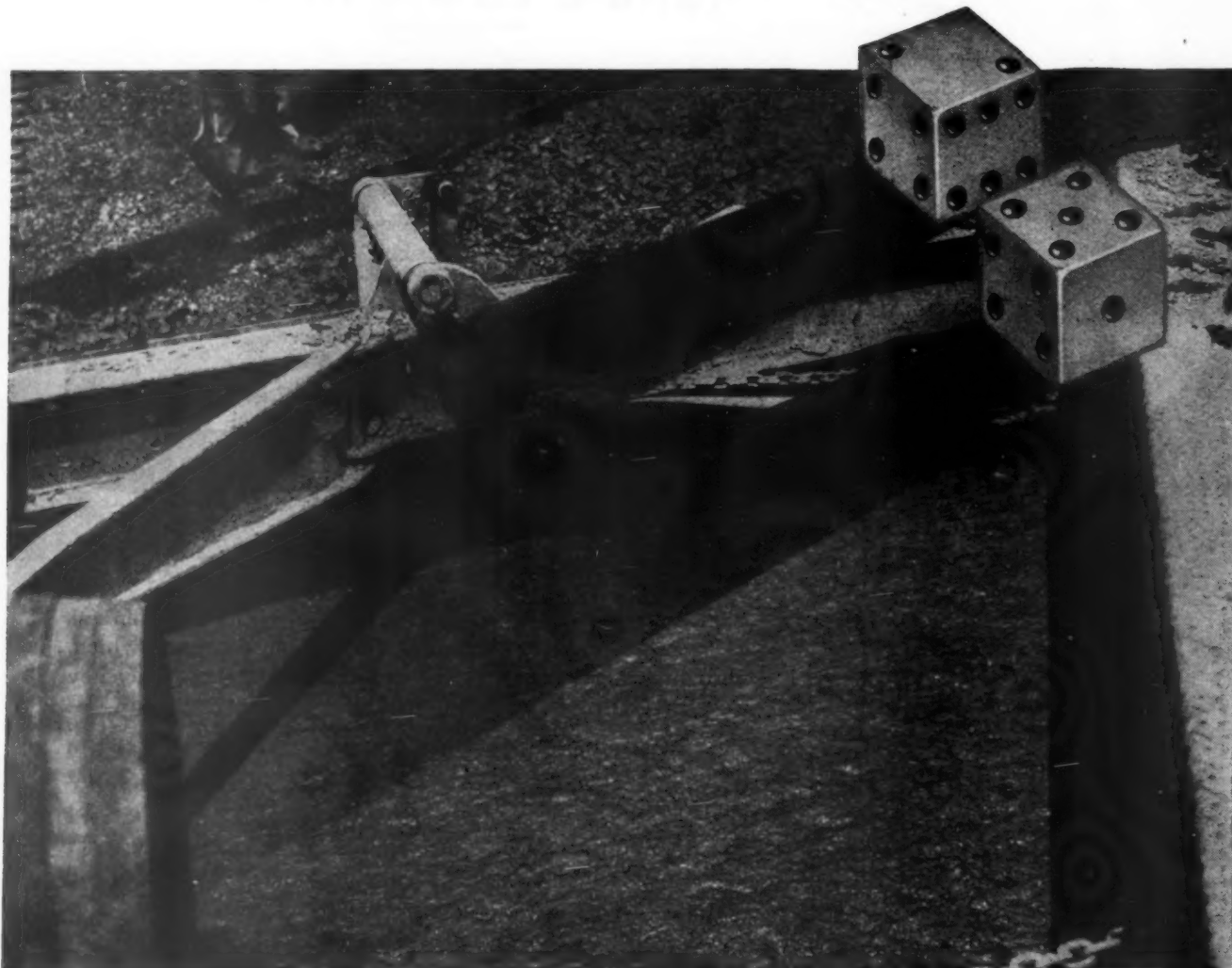
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Pioneers and Originators of *TANK CAR HEATERS *BITUMINOUS BOOSTERS *AUTOMATIC STEAM-PLANTS

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With only one pass!



Concrete after first and only pass of finishing machine on Army airport paving project. L. G. Defelice & Son, Inc., contractor, North Haven, Conn.

Here's how a contractor saved time and money. He used Atlas Duraplastic, the air-entraining portland cement that makes concrete more workable and practically eliminates segregation and bleeding. He reports—

Only one pass of the screeding machine was necessary to produce a desirable surface for finishing.

Finishers floated, edged and jointed the concrete surface immediately behind the screeding operation.

This saved time and expense at the termination of each day's concreting.

Atlas Duraplastic requires no additional materials and makes better concrete at no extra cost.

Send for further information. Write to Technical Service Bureau, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 135 East 42nd St., New York 17, N. Y.

OFFICES: New York, Chicago, Albany, Boston, Philadelphia, Pittsburgh, Cleveland, Minneapolis, Duluth, St. Louis, Kansas City, Des Moines, Birmingham, Waco.

RS-D-16

ATLAS DURAPLASTIC

TRADE MARK REG.
U. S. A. C. CO.

The Air-Entraining Portland Cement That Makes Concrete More Durable and More Plastic

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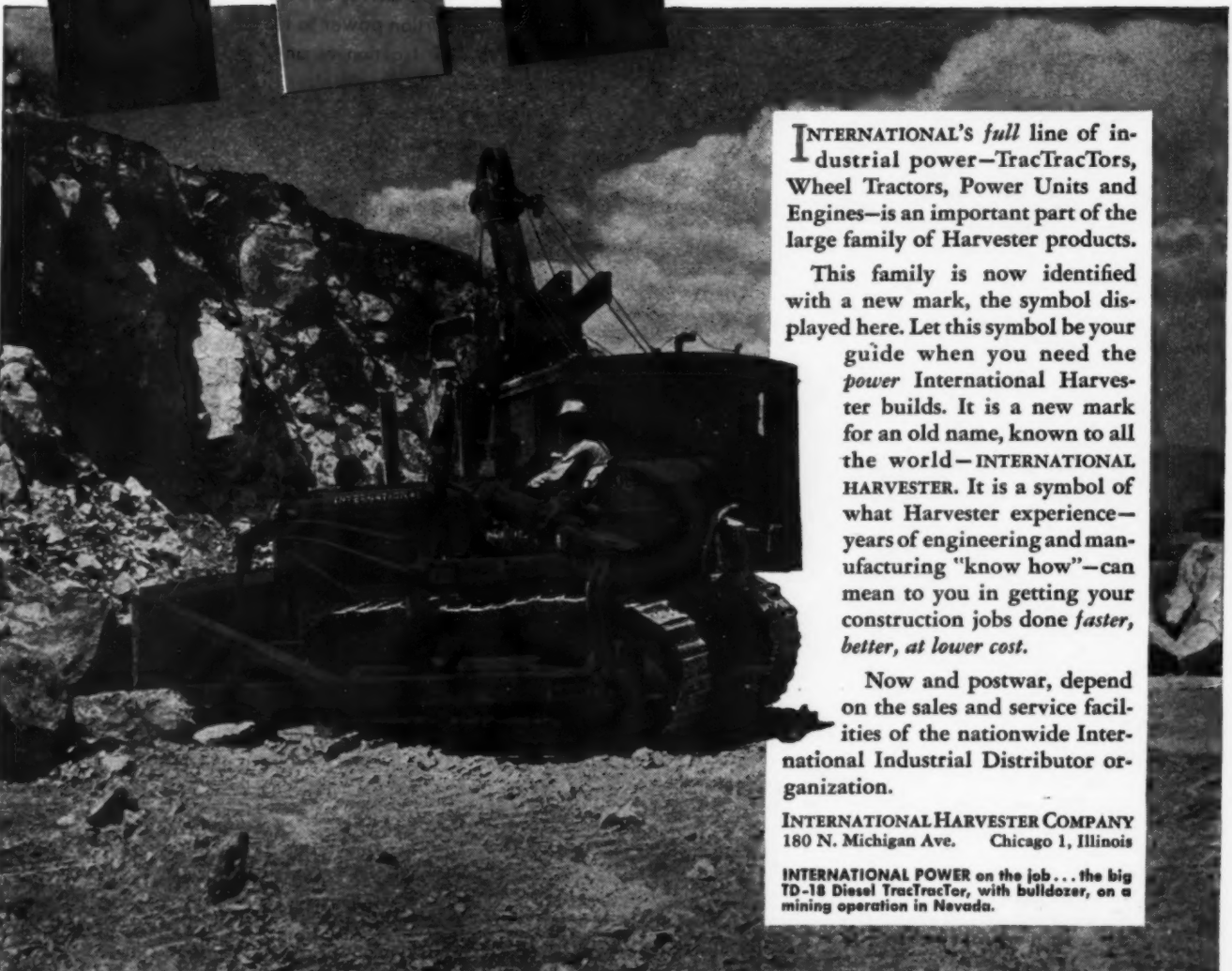


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INTERNATIONAL'S *full* line of industrial power—TracTracTors, Wheel Tractors, Power Units and Engines—is an important part of the large family of Harvester products.

This family is now identified with a new mark, the symbol displayed here. Let this symbol be your guide when you need the *power* International Harvester builds. It is a new mark for an old name, known to all the world—INTERNATIONAL HARVESTER. It is a symbol of what Harvester experience—years of engineering and manufacturing "know how"—can mean to you in getting your construction jobs done *faster, better, at lower cost.*

Now and postwar, depend on the sales and service facilities of the nationwide International Industrial Distributor organization.

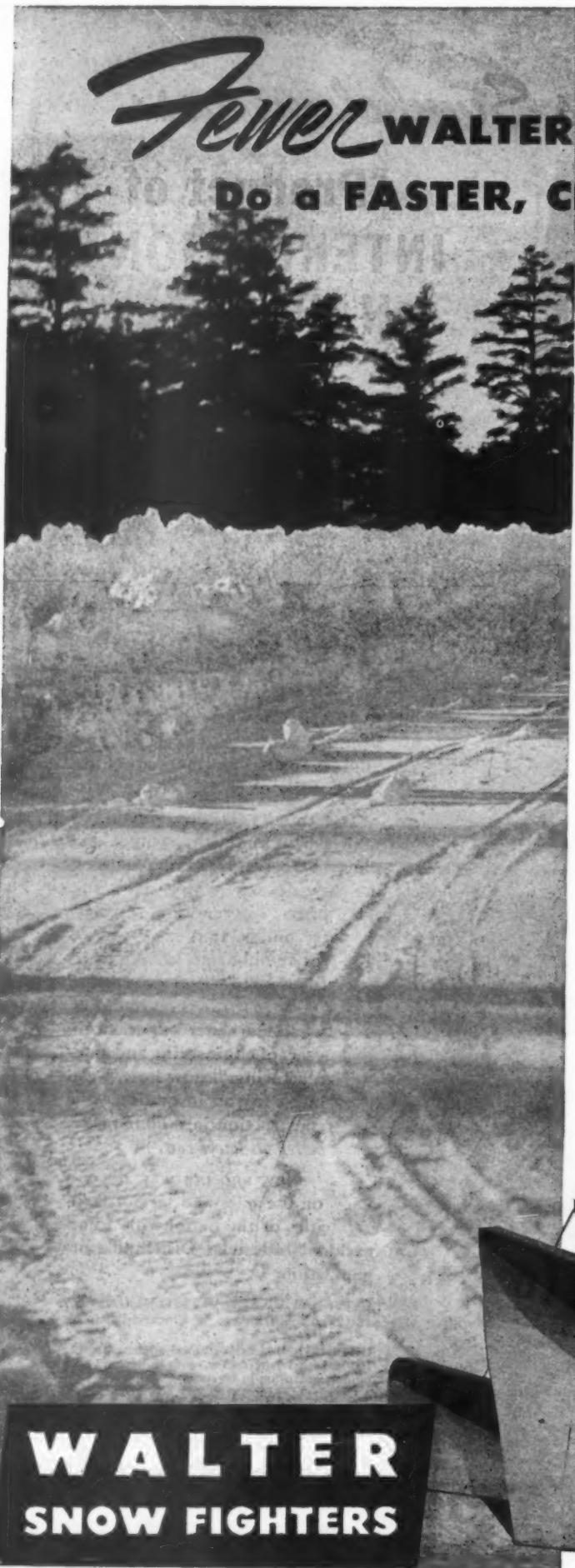
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180 N. Michigan Ave. Chicago 1, Illinois

INTERNATIONAL POWER on the job... the big TD-18 Diesel TracTracTor, with bulldozer, on a mining operation in Nevada.

Power for Victory... Power for Peace
INTERNATIONAL HARVESTER

Fewer WALTER SNOW FIGHTERS

Do a FASTER, CLEANER Job!



**WALTER
SNOW FIGHTERS**

The great volume of snow removed per hour by Walter Snow Fighters enables them to effectively clear more miles of highway per day than conventional rear-wheel and four-wheel drive trucks. These specialized units clear important roads sooner after the heaviest blizzard—gain you extra time for opening secondary roads.

Positive traction, which fully utilizes tremendous motor power, is the unique Walter feature which makes this performance possible. In the exclusive Walter Four-Point Positive Drive, three automatic locking differentials proportion power to FOUR driving wheels according to their traction at any instant. Full horsepower is utilized in driving Walter Snow Fighters on snow and slippery surfaces—none is wasted on wheel-spinning, slipping and stalling, common failings of other drive units.

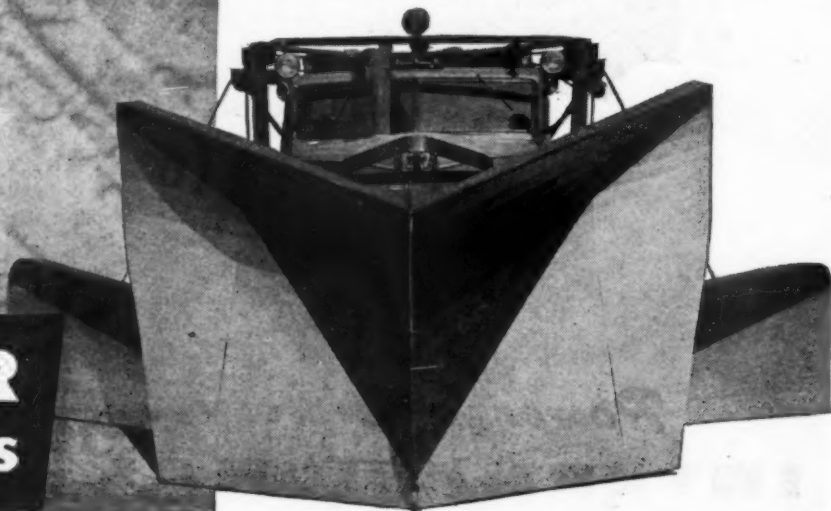
In battling the heavy blizzards of this severe winter, Walter Snow Fighters have again proved their superiority on American and Canadian highways.

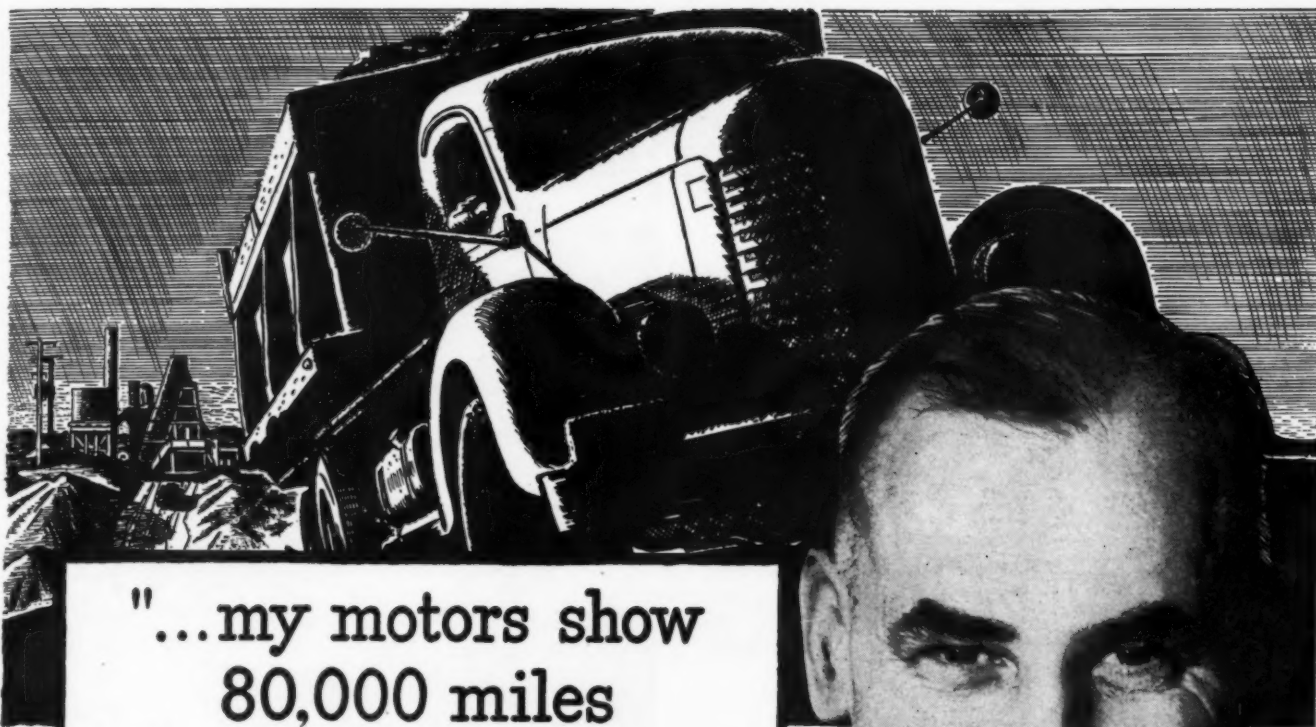
FASTER—The 250 h.p. Walter Snow Fighter reaches plowing speeds as high as 30 m.p.h.—speeding up all phases of snow removal from drift-busting to widening-out.

CLEANER—It clears a 28 ft. width in one run, a two-lane road in one round trip. Hydraulically-controlled center scraper attachment cleans hard-packed snow and ice to pavement.

SAFER—Snow is removed before it packs and freezes into dangerous ruts.

WALTER MOTOR TRUCK CO., 1001-19 Irving Ave., Ridgewood 27, Queens, L.I., N.Y.





"...my motors show
80,000 miles
without major repairs"

"...we have the distinction of being the first Ring-Free users in Buffalo. Our first trial was in two Ford trucks seven years ago.

...our fleet has increased to fourteen trucks including Autocars, Internationals, Fords and one Chevrolet.

...trucks are all used in hauling sand and gravel...the hardest kind of work on trucks as roads are bad...loads are heavy. Due to conditions there is a constant uneven strain on motor bearings.

...if Ring-Free did not have a tough film strength that protected these bearings my motors would not be able to show 80,000 miles without major repairs as many of them have.

...Ring-Free's ability to penetrate even to the top of the pistons and keep the upper rings free gives my motors all the power they were intended to have.

...my first International truck went 110,000 miles with only \$50 repairs...proper lubrication was responsible."

Excerpts from letter of—

George Muehlbauer

George Muehlbauer
205 Courtland Avenue
Buffalo, New York

**MACMILLAN
RING-FREE
MOTOR OIL**

Operators of all types of equipment report lower-cost, more efficient performance with Ring-Free Motor Oil. Find out how Ring-Free can help lick your toughest lubrication problems. ... Phone or write the nearest Macmillan office.

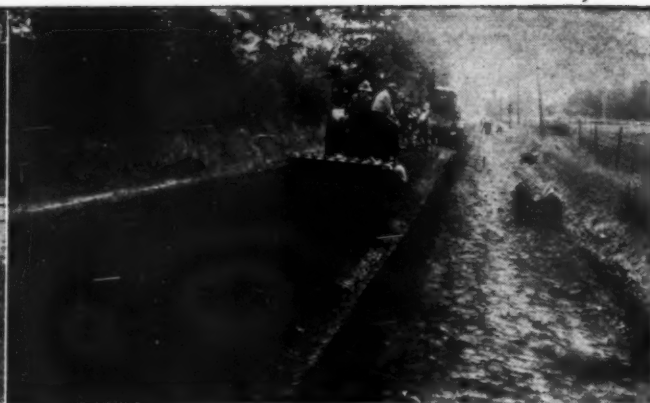
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One of several streets in Rome, N. Y. reconstructed with soil-cement.



Reconstruction of old rock road near Arthur, Ohio with soil-cement. Project sponsored by Paulding County officials.



5-ft. soil-cement shoulders on U. S. Highway 87, near Plainview, Texas.



Putting finishing touches to newly compacted soil-cement patch which soon will carry traffic.

SOIL-CEMENT SOLVES SPRING BREAK-UP PROBLEMS

Severe winters are usually followed by serious Spring break-ups of inadequate roads and streets.

Soil-cement is ideal for salvage, reconstruction, maintenance, widening and shoulder work on gravel, crushed stone and granular-type roads and streets which are damaged by Spring break-ups. Soil-cement meets WPB

rulings and the requirement of rigid economy.

Patch maintenance is simple with soil-cement and the patches "stay put."

Four-page illustrated data sheet (No. SCB-6) based on field experience will be mailed to aid engineers in reconstruction and maintenance operations with soil-cement. Free in United States and Canada.

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A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

BUY AND KEEP MORE WAR BONDS

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**That Means LOWEST
PER YARD... PER TON... POSSIBLE COST
PER ACRE!**

When the time comes to buy new equipment for tomorrow's earthmoving and land clearing jobs, it will pay you to remember the mark LPC, as your guide to lowest possible cost. For LPC stands for LaPlant-Choate—the job-proved line of tractor equipment that's known and respected the world over for its outstanding performance on thousands of tough jobs. Designed and built by "specialists" with over 34 years of practical "know-how," LaPlant-Choate equipment will continue to be a step ahead in improvements that assure lowest possible cost per dollar invested. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa.



ALL TYPES OF DOZERS*—
Straight or angling blade, hydraulic or cable operated, for every size of track-type tractor.



LARGE OR SMALL SCRAPERS
—Hydraulic or cable operated, front or rear dump, for use with wheel or track-type tractors.



CABLE OPERATED RIPPERS—
For ripping up hard ground, shale or concrete to facilitate loading with "Carrimor" Scrapers.



LAND CLEARING TOOLS—A complete line of Brush Cutters, Tree dozers, Root cutters and Brush Rakes—all interchangeable.

* Again in '44, LaPlant-Choate delivered more dozers to the armed forces and other essential users than any other company in the industry—almost as many as all the other manufacturers combined



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EARTHMOVING AND LAND



CHOATE

CLEARING EQUIPMENT

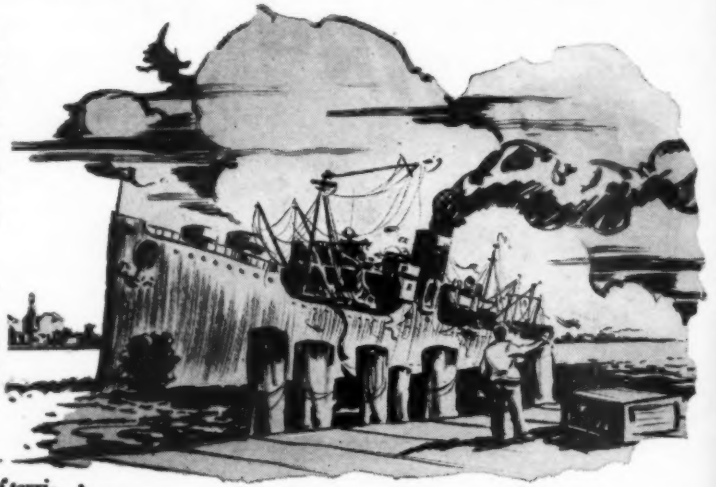
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THE INSIDE STORY OF A FIGHTING PUMP

Saved . . . more than a ship

● Like a phantom ship she crept into a west coast port . . . crippled and patched. Just one little thing averted a tragedy and kept her, along with all hands, from a watery grave . . . a Barnes portable pump lashed to the bulkhead. This Barnes pump performed ceaselessly, stemming the hairline tide between "Davey Jones' Locker" and making port. Not only a much needed bottom, but many lives and a valuable cargo were saved.

Barnes Automatic Centrifugal Pumps are unfalteringly doing their job under every war condition. Redesigned and modernized for military and naval requirements they have now been further perfected and stream-styled to give you *more gallons of water for your pumping dollar.*



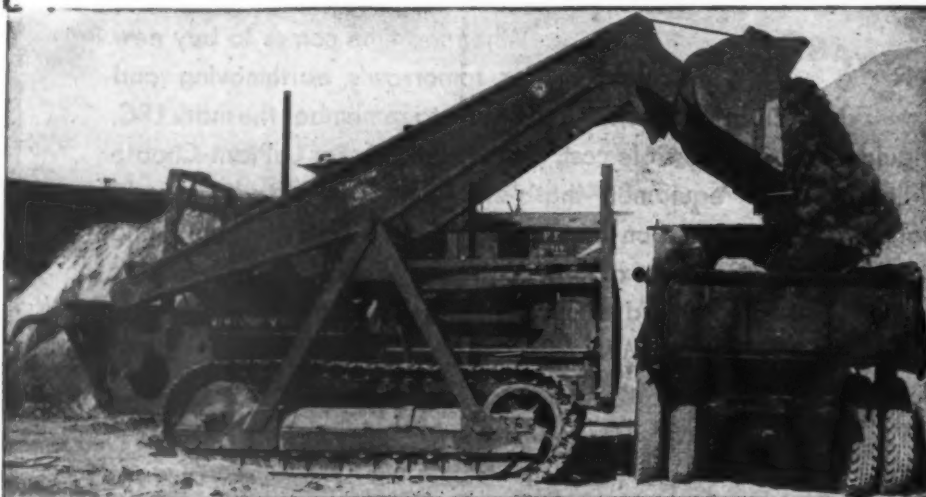
ATTENTION DISTRIBUTORS! A number of territories are still available. Write, wire or phone.



BARNES MANUFACTURING CO.

Quality Pump Manufacturers for Nearly 50 Years

MANSFIELD, OHIO

McCAFFREY TRACTOR SHOVEL

1¼-yard capacity bucket.

- 100% cable control of bucket.
- Weight centered on truck frame.
- Design permits bucket to reach over center of the truck.

For sizes and specifications of this unit write to:

M. P. McCAFFREY, INC.

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Stop **RUST** losses with new **WAR-BORN PREVENTIVES**

RUST—a nuisance and a very costly menace in many places no longer need be tolerated. Laboratory magic has furnished its master.

New Sinclair products, developed to solve tremendous military rust problems, are now available for your problem.

Sinclair **RUST-O-LENE B** for exposed metal surfaces of machinery in operation, in storage, or in transit

- provides a firmly-adhering rust proofing film
- prevents rusting of clean surfaces
- halts further rusting of corroded surfaces
- has lubricating qualities
- defies any degree of moisture from mere dampness to heavy rain
- can be readily removed when desired

Sinclair **OPALINE RP** (Rust Preventing) OILS for enclosed oil systems, prevent internal rusting of engines, hydraulic systems, gear reducers, and similar machinery intermittently operated, stored, or transported. **OPALINE RP** also has ample lubricating qualities for temporary use.

Both these remarkable Sinclair rust-preventives have successfully passed the most exacting service tests, and fully meet Government specifications.

Learn how **RUST-O-LENE B** and **OPALINE RP** can combat rust for you. Write for brochure giving full details.

SINCLAIR LUBRICANTS-FUELS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

Rust-O-Lene-Opaline Reg. U. S. Pat. Off.

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NO-DRAG HAULS with this sure-roll tread

Goodyear All-Weather Earth-Movers on Bucyrus-Erie Scraper powered by International Diesel Tractor.

THEY'RE sure-footed. They're rugged. And these Goodyear All-Weather Earth-Mover tires really roll under full load — roll without time-wasting drag.

That's because their wide, rounded contours — which permit low inflation — provide the flotation needed for easier hauling. And the wider tread channels and sturdy diamonds of that famous All-Weather tread make for freer rolling and protection against snagging.

Fortified with a rugged bead construction which provides security against rocking, chafing and rim cutting, these tough giants are now further armored with Goodyear's patented Rayotwist cord — *the strongest body we've ever used in a work tire.*

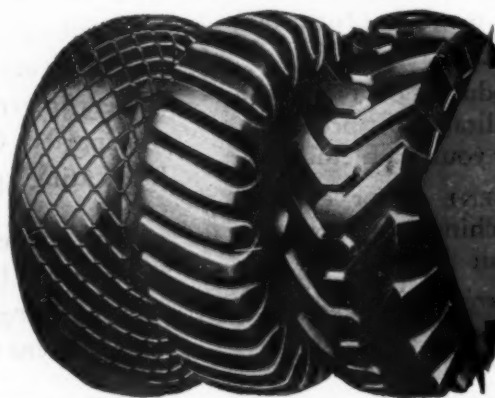
That's why we score them as the

best work tires built from today's synthetic and permissible natural rubber — best for longest life and maximum efficiency.

More contractors than ever before

now buy these All-Weather Earth-Movers for their drawn units. And with Goodyears on your units you will soon know why "more tons are hauled on Goodyear truck tires than on any other kind."

THE RIGHT TIRE FOR EVERY JOB Rayotwist-armored for extra strength



For drive wheels, Goodyear's
**O-P-E-N
C-E-N-T-E-R**

self-cleaning tread gives
more pull, more traction

**ALL-WEATHER
EARTH-MOVER**
for drawn vehicles

**HARD ROCK
LUG**
for all rock work

SURE-GRIP
for drive
wheels

PRODUCTS OF
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All-Weather, Rayotwist, Sure-Grip—T.M.'s The Goodyear Tire & Rubber Company

GOOD YEAR

THE GREATEST NAME IN RUBBER

ROADS AND STREETS, April, 1945 ← Please mention when writing advertisers

ROADS AND STREETS

April, 1945, Vol. 88, No. 4

Controlling Erosion in Big California Cut

How 28,000 square yards of slope was top-soiled, mulched, disced, seeded, given partial set-out planting and watered at total cost of 20 cents per sq. yd.

By H. F. CATON

Resident Engineer, California Division of Highways,
District XI, San Diego

EROSION control to decrease maintenance is financially profitable in the deep cuts that go with modern grade standards. An example of the latest labor-saving technique developed in California is afforded by the methods used in 1944 on a relocation S.H. 199 in San Diego County. Work was performed by contract.

The cut in question is about 50 ft. deep and a mile in length, with 2 to 1 cut slopes. It was originally planned to develop erosion controlling growth by discing the face of the cut and spreading over it approximately three inches of top soil, which had been salvaged and stockpiled. But before the seed could sprout and mature, heavy seasonal rains eroded the slopes and repairs were imperative. It was



Discing cut slope prior to spreading top soil. Grader below is cabled to tractor above

Punching in straw with sheepsfoot roller cabled between two tractors





Untreated 2:1 slope after rain, showing result of erosion



Spreading straw over top soiled slope to provide a mulch



Planting Ice Plant cuttings through straw along top and bottom of slope



Rye grass and barley crop growing through straw mulch

evident that any seasonal rains supplying sufficient moisture to germinate the seed would cause erosion before plants could take root to the erosion preventative stage.

It was decided to do the work during the dry season when artificial or controlled watering could be used, and also that rye and barley seed should be added to the soil to give a rapid and uniform growth.

Soil Dumped from Top; Straw Mulch Used

To form a proper seed bed, the area was mulched with four to five tons of straw per acre. Control measures were worked out in conjunction with Landscape Engineer H. Dana Bowers, from the Sacramento Headquarters Office.

The 2:1 slope permitted use of heavier equipment for a major part of the work. The surface was prepared for top soil by a 12-ft. patrol and disc, operating horizontally on the cut face and held in position against side slipping by a tractor operating along the top of slope.

The top soil was dumped over the tops of the cuts and worked down over the face using the same patrol and tractor. Preparation of the face by this method was rapid and nominal in cost.

Baled straw was distributed in the right proportion along the tops of the slope and spread downward by hand labor, using hay forks.

Seed Spread Over Straw

Barley seed at rate of 1 lb. per 200 sq. ft. and rye seed at 1 lb. per 170 sq. ft. were then spread over the loose straw, using a small manually operated one-man centrifugal seed spreader. This seeding was considerably heavier than for commercial crops.

With the seed and straw in place, several methods were attempted to properly mix the mulching straw with the top soil. These methods included a disc harrow, several types of tampers, and a crawler type tractor with extra deep grousers. None proved satisfactory until a single section sheepsfoot tamper with a high frame was used. This method obtained results far in excess of any anticipated.

The sheepsfoot tamper was drawn back and forth on the face of the cut, parallel to the roadbed, by means of a tractor operated from the top of the cut, a patrol operated from the pavement, and the roller operating between the two by a cable bridle.

Straw Tamped Into Soil

All areas were covered by the tamper from two to three times, which sufficed to drive the straw to a depth of from 3 to 6 in. The above method of operating the sheepsfoot tamper horizontally on the face of the fill was possible because of the uniform height of the cut face and the fact that good operating surfaces for the

tractor and patrol were available, both at top and bottom of cut.

Additional experimental work indicated that on cuts with an irregular top, where it would be impossible to tow the tamper horizontally, good results and progress could be obtained by operating the tamper up and down the face of the cut, with a cable operated from the hoist drum on the rear end of the tractor. The same results could no doubt be obtained using a winch truck.

Water Line Installed

A 4-in. water line was installed along the top of the cut, and outlets were provided at intervals of 150 ft. Water was applied by hand from 1-in. hoses. Two or three men, 8 hours per day, were required to keep the mile length of treated slope properly moist. A surface ditch was excavated about 15 ft. back from top of the slope, parallel to centerline, and at 500-ft. intervals, redwood timber downdrains were constructed, leading into existing culverts.

Additional erosion protection, as well as fire control during the dry summer, was provided for by planting *Mesembryanthemum Edule* (Ice Plant) at tops and lower parts of the slope (four rows top, four at bottom). This was done by hand, and a considerable portion of the actual placing was done by women, who adapted readily to this work.

Growth in Three Weeks

Germination of the rye and barley seed started within five days, and watering continued for three weeks, at which time the growth averaged some 6 in. in height, and was very luxuriant, as illustrated in accompanying photographs.

The cost of the completed erosion

protection, including materials, placing of straw, scattering of seed, planting and fertilizing of Ice Plant cuttings, construction of down drains, and watering, was about \$5,600 for 28,000 sq. yd., or about \$0.20 per sq. yd.

E. E. Wallace is San Diego district engineer of the California division of highways, of which G. T. McCoy is state highway engineer.

Latest Developments in Surplus War Equipment Disposal

THE speed of surplus equipment disposal is being stepped up everywhere, observes a bulletin from the American Road Builders Assn. So great is the problem in the Reconstruction Finance Corporation that a new building is being erected in Washington, D. C., to house the personnel that will handle its sales operations. Office space in the 31 regional offices of R.F.C. will be greatly increased and 61 disposal centers throughout the country are being established. 39 depots are now in operation.

Government Agencies Advisory Council

The Surplus Property Board has established an advisory council of 19 Government agencies through which these agencies can present their views to the Board on matters relating to the care, handling and disposal of surplus property. Principal representatives will meet from time to time with the Board and the Administrator. The 19 agencies are: Departments of State, War, Navy, Justice, Interior; Procurement Division of the Treasury Department, U. S. Maritime Commission, Reconstruction Finance Corporation, War Production Board, Office of Price Administration, Veterans Administration, Federal Works Agency, Civil Aeronautics Board, Smaller War Plants Corporation, Foreign Economic Administration, War Food Administration, Department of Agriculture, National Housing Agency, and Office of Contract Settlement.

Spare Parts Shortage?

Since the first meeting of the Manufacturers committee on war surplus equipment, anxiety has been expressed over the potential surplus of spare parts. Therefore, the following is of interest: Great concern is being expressed by high ranking Navy officials over the spare parts SHORTAGE, which, according to a Navy release, has worried government procurement agencies for months. Fleet Admiral Nimitz says, "A constant flow of spare parts to the fleet is necessary immediately." One authority reports

that landing operations in the Pacific have been endangered by the shortage of parts for cranes, bulldozers and other equipment.

Navy officials advise that in the early part of the war large stocks of spare parts were ordered. That experience has proven some types of spare parts are not needed in large quantities and that other types are readily expendable. Spare parts are vitally needed for trucks, shovels, cranes, tractors, wagon drills and similar equipment.

Army officials advise that there are quantities of certain types of spare parts available and a critical shortage in others . . . that such a condition is inevitable because requirements are as unpredictable as war itself.

Special Congressional Committee Investigates Disposal

Recently the Subcommittee on War Surplus Property of the Special Committee to Study Problems of American Small Business, U. S. Senate, made its third report. Following is a summary of the findings, and recommendations. Findings:

1. Inventories of unsold surplus goods were accumulated during 1944 in many classes of goods in short supply.

2. The broad channels of normal trade numerically dominated by small business were not used to the fullest extent to move goods rapidly to the consumer.

3. This was true because goods were frequently disposed of in large lots which could not be absorbed by small businesses, even in the wholesale trade; the methods of advertising and notification of sales were not adequate to properly inform small businesses of available surpluses; (In some instances, no formal advertising); the agency had not yet found means for using many of the trade practices customary to normal trade channels.

4. No established pricing policy had been arrived at and the market was tested before sales in an unsystematic fashion.

5. This "as is, where is" basis of sale led in many instances to sales to speculators. Several such sales were negotiated through the central office, rather than through the regions where individual businessmen could learn of them.

6. In an effort to achieve distribution through the regular trade channels, policies were established which gave the original manufacturer a favored position in the purchase of surpluses.

Recommendations:

1. Sale of goods in lots small enough for the small businesses in the distributive level of trade solicited.

2. Widespread advertising and systematic notification of sale through broad mailing of listings of surplus goods and through all other suitable avenues of publicity. The Surplus Reporter, a monthly listing of surplus property by regions and by broad classes, which came into use by the agency shortly before your subcommittee hearings, appears to be a step in the right direction.

3. The Treasury Department should conform as nearly as possible to customary trade practices in the sale of those goods for which there is demand in the normal trade channels. This involves delivering the goods as advertised, which depends primarily on an adequate description of the goods by the armed services; more widespread use of samples and improved display; refunds to purchasers on goods which have been misrepresented; the extension of normal trade credit to purchasers of surplus goods.

4. The establishment of a reasonably uniform pricing method with the use of fixed prices adjusted to the various distributive levels in many instances. Such prices should be uniform within a given distributive level and should be based on a thorough testing of the market.

5. Disposal procedures along the lines of those indicated should be designed so as to exclude the speculator automatically from the purchase of goods in short supply.

6. Sale of goods to the original manufacturer has no special virtues in and of itself; where disposal to the manufacturer has clear-cut advantages in terms of the objectives of the act, the goods should be offered, if possible, to all competitive manufacturing firms, rather than to the original manufacturer only.

New Procedure for Treasury Surplus

Treasury's Office of Surplus Property, a disposal agency designated by the Surplus Property Board, early in April inaugurated a new nation-wide



Granite City Machinery Sale—Over 550 pieces of construction equipment ranging from \$20 to \$5,000 in bid price, went under the auctioneer's hammer at treasury Procurement's sale, held March 19, 20 and 21 at Granite City, Ill. Representing one of the best managed sales from the standpoint of "established channels" in the machinery business, this event was attended by 130 dealers. Sales proceeds totaled \$135,000, representing purchases made in most instances by distributors or dealers after personal inspection of the units out on a muddy display lot in a spring drizzle. Condition of equipment offered ranged from good to poor, according to remarks from the customers. Most of the units came from Army camp and other war projects in the U. S. Engineer Great Lakes Division



Looking into the horse's mouth at the Granite City Sale—H. L. Armstrong and Jack Frost of Michigan Tractor & Machinery Co., Detroit

synchronized spot sales program for the disposal of surplus construction and farm machinery. The plan is the result of many months of research into surplus sales experiences after the last war and into experience to date under present-day conditions:

Spot sales are so designated because the merchandise is disposed of where located. Ample opportunity for preliminary inspection of the equipment is afforded. Thereafter, a numbered list of equipment items is offered to the assembled bidders one item at a time. The bidders, then and there, as each item is called, submit written bids. The bids are collected immediately after the calling of each item, the highest bid determined, and an award announced immediately. Contracts are signed and full payment made on the spot or within a day or two, as designated.

The program of synchronized spot sales calls for regular spot sales within the same region on the same day of each month.

Disposal efforts will be divided into eleven regions, all of which will employ the Synchronized Spot Sales Method. Inventories at the present time are centered in the Central Mid-West and Southern Mid-West.

About 50% of the entire treasury inventory of construction machinery and farm equipment is at the present time located in regions 7 and 8, at Fort Worth and Kansas City. Seattle, in region 11, and Atlanta, in region 6, also have heavy inventories.

These regions, the Corps of Engineers forecasts, will continue to be areas of large declarations for some time to come. The sales program is therefore being planned so that bidders from the West and East coasts may be permitted to follow respec-

tive travel cycles, each of which will join at Kansas City. Two travel cycles have been planned, one for the eastern part of the country and the other for the western part of the country, with regularly scheduled sales so spaced as to permit dealers from all sections of the country to attend the sales in the mid-western regions. In other words, dealers from the two coasts will meet for the largest sales which will be held in the Kansas City, Fort Worth and Atlanta regional areas.

By having a fixed time and a fixed day in every month in every region for such sales, the spotlight automatically focuses at one given point at a single time.

Treasury's Monthly Spot Sales Dates

BOSTON (Region I) J. D. Tompkins, Regional Director—May 7, 8, 9; June 4, 5, 6; July 2, 3, 4.

NEW YORK CITY (Reg. II), Frank L. Seymour, Reg. Dir.—May 3, 4, 5; June 7, 8, 9; July 5, 6, 7.

WASHINGTON, D. C. (Reg. III), M. P. Shlessinger, Reg. Dir.—May 14, 15, 16; June 11, 12, 13; July 9, 10, 11.

CINCINNATI (Reg. IV), R. D. Schell, Reg. Dir.—May 10, 11, 12; June 14, 15, 16; July 12, 13, 14.

CHICAGO (Reg. V), F. A. Mapes, Reg. Dir.—May 21, 22, 23; June 18, 19, 20; July 16, 17, 18.

ATLANTA (Reg. VI), H. E. Harman, Reg. Dir.—April 26, 27, 28; May 24, 25, 26; June 28, 29, 30; July 26, 27, 28.

FORT WORTH (Reg. VII), Hamilton Morton, Reg. Dir.—April 23, 24, 25; May 28, 29, 30; June 25, 26, 27; July 23, 24, 25.

KANSAS CITY (Reg. VIII), Thomas C. Stephens, Reg. Dir.—April 19, 20, 21; May 17, 18, 19; June 21, 22, 23; July 19, 20, 21.

DENVER (Reg. IX), Alden W. Pool, Reg. Dir.—May 15, 16; June 19, 20; July 17, 18.

SAN FRANCISCO (Reg. X), John F. Hough, Reg. Dir.—May 8, 9, 10, 11, 12; June 12, 13, 14, 15, 16; July 10, 11, 12, 13, 14.

SEATTLE (Reg. XI), Orrin C. Bradeen, Reg. Dir.—May 1, 2, 3, 4, 5; June 5, 6, 7, 8, 9; July 3, 4, 5, 6, 7.

\$37,500,000 Provided for National Forest Roads

The Federal Aid Highway Act of 1944 provided \$37,500,000 for the first post war year for roads and trails

within the national forests. This work is under the general direction of the U. S. Forest Service, Washington 25, D. C., of which G. H. Lantz is acting chief, division of engineering. The distribution of these funds follows:

State.	Forest Highway Fund	Forest Road Development Fund
Alabama	\$ 96,376	\$ 90,000
Alaska	1,500,000	105,000
Arizona	1,439,281	367,000
Arkansas	334,226	232,000
California	3,562,884	2,618,600
Colorado	1,812,914	513,100
Florida	206,989	80,000
Georgia	95,067	80,000
Idaho	2,553,938	1,611,800
Illinois	41,587	70,000
Indiana	16,869	3,000
Iowa	1,191
Kentucky	55,947	133,400
Louisiana	80,289	57,000
Maine	13,784	4,000
Michigan	343,712	190,000
Minnesota	331,644	160,000
Mississippi	121,377	177,000
Missouri	163,420	132,000
Montana	1,984,970	833,000
Nebraska	34,051	7,600
Nevada	453,420	116,600
New Hampshire	195,092	75,700
New Mexico	1,022,864	468,000
North Carolina	153,573	147,000
North Dakota	133
Ohio	14,632	12,000
Oklahoma	23,051	22,000
Oregon	3,421,661	1,646,400
Pennsylvania	96,320	76,800
Puerto Rico	9,876	47,000
South Carolina	115,928	67,000
South Dakota	289,299	109,300
Tennessee	118,988	87,000
Texas	115,884	131,000
Utah	835,671	325,400
Vermont	36,171	45,900
Virginia	174,120	215,100
Washington	1,751,258	933,800
West Virginia	107,866	142,100
Wisconsin	193,726	118,000
Wyoming	1,079,951	249,400
Total	\$25,000,000	\$12,500,000

Colombia Plans Highway Loan

Bogota, Colombia.—The Government has authorized an internal loan of 10,000,000 pesos, of which more than 4,000,000 pesos is destined for the construction of strategic highways and the rest for the purchase of military equipment. The loan is to be represented by bonds, the terms of which have not been announced.

Partial List of Important New Construction or Heavy Repair Projects

Reported for 1945 by State Highway Departments as of April 1

State.	New Construction.	Repairs, Resurfacing, Widening.
Idaho	None to date.	585 mi. of "maintenance" reconst. or betterment, 260 mi. of which lies on 6 heavily traveled routes.
* Kansas	Eight bridge replacements on War Emergency Relief Program, \$686,000.	1500 miles of bit. sealing of bit. surfaces on aggregate type roads, to be let by contract.
Kentucky	1.0 mi. thru Frankfort, grade, drain, pave; 20 mi. bridge and approaches, Fayette-Madison (at \$250,000); 4 mi. farm route; 15.1 mi. mine roads; ferry approaches; total, \$1,038,000.	\$4,000,000 L-41-e program.
Massachusetts	Replace old bridge, 332 ft.; W. Springfield; \$250,000. Reloc. rte. 202 around flood control area, Templeton and Winchendon, 506 mi. in 2 proj.; \$561,000; also grade elim., \$112,000. 1½ mi. resurf., Brookline-Newton, rte. 9, \$60,000.	No data.
Michigan	None to date.	\$2,800,000 in contracts let for bit. surface treatment, concrete patching and gravel resurf.
Minnesota	8.15 mi. grading stab. base, bit. surf. U. S. 10, \$872,000; contract let 1944. Bridge over Miss. River, 770 ft. length.	No data.
Mississippi	Completion of 3.6 mi. relocation U. S. 51 across Arkabutla Reservoir (U. S. Engineer project, state aid).	No data.
Missouri	None to date.	80 mi. of U. S. 40, 61 and 66 to be bit. resurf. by contract, est. cost \$1,000,000.
Montana	57.8 mi. of new projects, grade, drain and various surfaces; strategic net, etc., at \$1,351,000. Two bridges: \$225,000 proj. Miles City; \$75,000 proj. near Bozeman.	No data.
New York	1.0 mi. concrete road, Nassau County, \$110,000.	45 mi. bit. resurf. of old concrete pav. \$1,000,000; to be let to contract.
North Carolina	\$316,813 proj. let in 1944 involving 600,000 cu. yd. swamp muck removal on Camden Causeway; R. C. Huffman Const. Corp., Norfolk. Similar project planned on U. S. 64 in Tyrrell County.	No data.
North Dakota	17 mi. reconst. U. S. 10, \$510,000; 44 mi. base and bit. mat. U. S. 10, \$750,000; 21 bridges in Western part of state, replacing flood destroyed; \$760,000.	No data.
Ohio	None to date.	Resurfacing, widening, \$6-7,000,000, by contract. Maintenance and repair surface treatment program, \$3½-4,000,000.
Pennsylvania	10.65 mi. of U. S. 22 four-lane divided highway E. of Harrisburg. 3 proj. totaling \$2,248,553 let Nov., 1944, to Potts & Callahan Contracting Co., Baltimore; strategic net.	Usual program of bit. treatment, and bit. resurfacing.
South Dakota	Several bridges; 12 mi. mat. construction.	No data.
Texas	None to date.	\$5,000,000 concrete widening program along 500 miles of 18-ft. concrete pavement, let to contract. \$5,000,000 smoothing and widening existing asphalt pav. with light materials.
Washington	9.0 mi. paving and 1.7 mi. gr. and pav. on U. S. 99, Woodland to Klammath; \$1,035,000. Strategic network project.	229.2 mi. ballast, surf. & bit. treat; 23.8 mi. grade and drain; 1,170,000 record bridges structures; 18.0 mi. pav. or repav.; \$18,000 traf. lights; 235.0 mi. bit. treat; total \$4,854,000.
West Virginia	1.0 mi. grade and drain, emergency flood drainage replacement; bridge and approach; 1.61 mi. paving 2 lane; 1.5 mi. 4 lane relocation access; raise three small bridges; total \$811,000.	No data.
Wisconsin	None to date.	270 mi. heavy bit. mat. resurfacing (80 mi. conc.); \$1,000,000. 246 mi. heavy gravel and stone resurf. \$1,250,000.
Wyoming	10.99 mi. new location, U. S. 87 Sheridan-Banner; three bridges.	48.7 mi. oil treated gravel or surfacing and oiling, in 2 proj.

Many States Plan Contract Improvements

As of April 8 the Illinois Division of Highways had 20 bridge or highway projects under contract for 1945 construction, according to chief highway engineer, W. W. Polk. Totalling \$3,981,000, these projects include individual contracts as large as \$623,000 and comprise emergency replacements, approved strategic network improvements or replacements, and access roads. Nine of the jobs involve bridges and seven are for concrete paving totaling 41 miles. This program ranks Illinois high among the states in 1945 highway construction.

New paving needed on U S 66, 34 and other essential main arteries in Illinois will be given \$5,000,000 worth of reconstruction as an emergency in 1945, if WPB approves. In petitioning for this work, chief highway engineer, Wesley W. Polk, pointed out that the state had \$36,000,000 in projects programmed in 1942 when road construction was stopped including \$3,600,000 in projects already let.

Also ranking high is California, which reports 65 surface repair projects, some 50 of which involve WPB authorization. These will total \$3,455,000. In addition, 120 bridge repair and replacement projects to cost \$438,000 are planned for the year according to state highway engineer G. T. McCoy. About \$328,000 in access projects are pending.

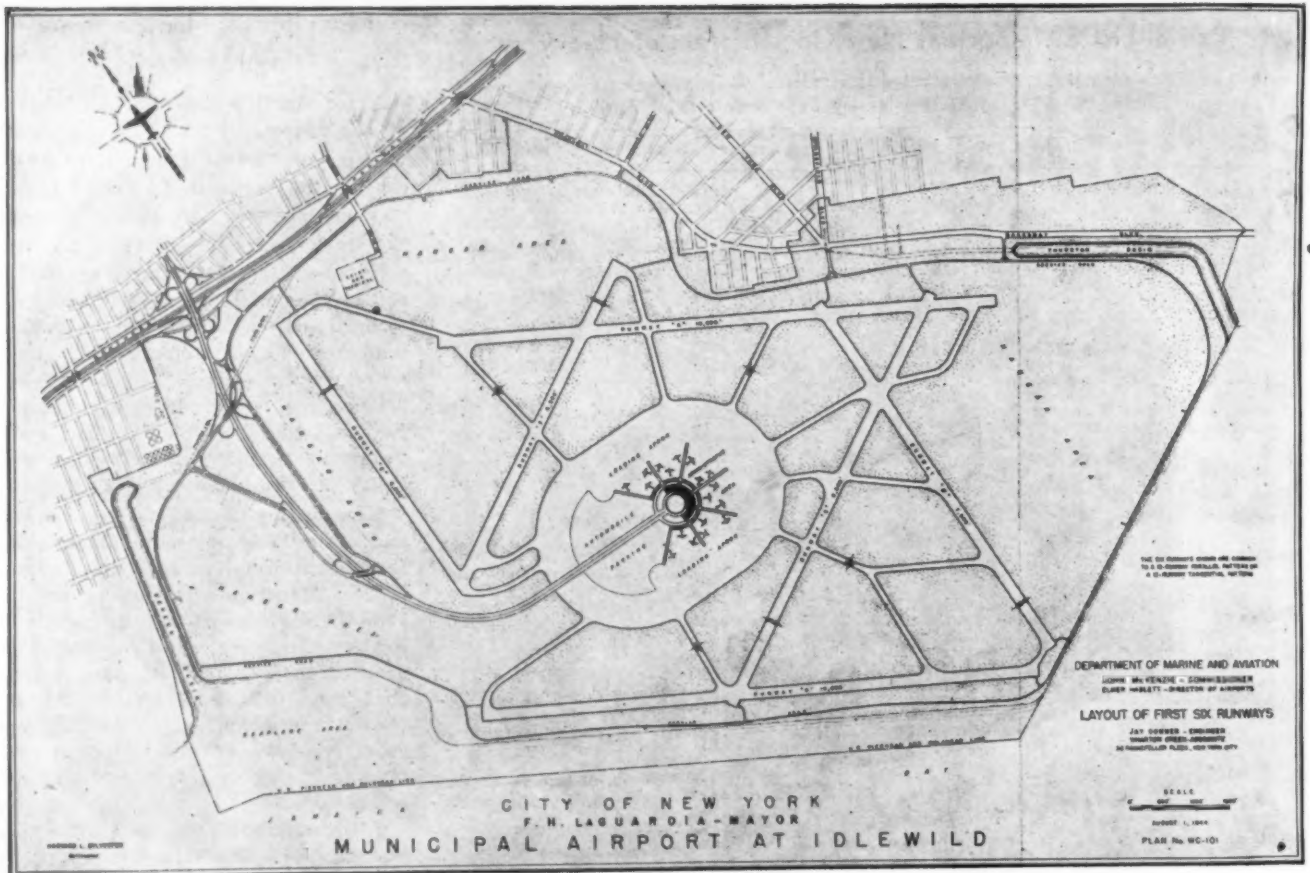
The accompanying table shows jobs definitely shaping up in twenty additional states reporting.

Third Edition of AED "Green Book" Now Available

Associated Equipment Distributors Praise OPA's "Very Thorough" Examination of Rental Rates Preliminary to MPR-134 and 136.

The Third Edition of the Associated Equipment Distributors' Compilation of Rental Rates for Construction Equipment, known throughout the industry as "The Green Book," is now off the press and available at cost to members and non-members of AED through the executive offices of the organization in the National Press Building here.

The Rental Rate Schedule is based entirely on Maximum Price Regulations 134 and 136 of OPA, the regulations set forth are an exact copy of the OPA regulations and, except where noted, the operating schedule of rental rates on construction machinery is likewise an exact copy of (Continued on page 96)



Layout of New York City's new Idlewild Airport, now under construction. This field is of special interest today because of the key place it will have in global aviation. Typical cross-section detail of its 12-in. concrete runways will be published in an early issue along with the concluding chapters of the paper presented herewith.

Where We Are in Airport Design

By HAROLD J. McKEEVER
Editor ROADS AND STREETS

SINCE 1940 an unprecedented volume of airport construction has been rushed to completion in the United States, mostly for military use. Over three thousand fields of all classifications, costing billions to build, are now in service. Design methods have come a long way in a short time, yet those who have had

the most to do with the subject feel that airport design, particularly pavement design, is still in its swaddling clothes.

This feeling is due to several circumstances. First, most fields have been paved under design formulas borrowed or adopted from highway work. Design agencies are only now

finding time to turn around and begin an exhaustive study of the service records of existing fields. Secondly, bigger and bigger planes are calling for constantly heavier and larger runways, with the solution of new soil and pavement unknowns.

For the facts contained in the following summary and comparison the author is indebted to the personnel of the Office of Chief of Engineers and various U. S. Engineer divisions, the Navy Bureau of Yards and Docks, the Civil Aeronautics Administration, the Public Roads Administration and officials of several municipal or private airfields and aircraft manufacturers. Particularly acknowledgment is given to the excellent design papers by Col. James H. Stratton, Corps of Engineers, and Gail A. Hathaway, Chief of Engineers Office, see "Military Airfields: A Symposium," Proc., ASCE, Jan., 1944, and the summary

What present and future plane loadings must be considered airport design? What are some of the typical layouts, dimensions, grades and other details of latest practice? What soil classification, subgrade evaluation and design procedures are now used in flexible and rigid pavement design? What fundamentals and trends can be highlighted in drainage practice? The following article on this timely subject is based on a paper prepared for the Airport Engineering and Construction Session, Annual Convention of the American Road Builders' Association, held recently in Chicago. The full paper will be available subsequently in the ARBA Convention Proceedings and is also being preprinted at this time and distributed by the Association along with other airport papers given at the meeting.

"Airport Design," by A. H. Hadfield, Asst. Chief, Airways Engineering Division, Civil Aeronautics Administration, in the Journal, Boston Society of Civil Engineers, July, 1944.

Let us look first at the load question. Four years ago at the start of the war program the DC-3 airliner with a 12,500-lb. maximum wheel load was the heaviest plane in general service. Up to then, runway designs based on highway experience were giving fairly satisfactory performance.

I. Wheel Loadings Today and Tomorrow

Today we have military planes with wheel loads up to 85,000 lb., which overtax even the Class I Army airfields (60,000 lb. design load). A considerable part of the Army and Navy airport work of 1944 consisted of strengthening and lengthening existing runways.

The end is not yet. Heavier planes for war and peace are being designed and the trend continues toward heavier and longer runways at major fields. For example, at Lindbergh Field, San Diego, Consolidated Aircraft and the Navy recently completed a concrete runway 8500x200 ft. designed 12 in. thick for a theoretical 85,000-lb. wheel load, but actually capable with base compaction of over twice this concentration.

Idlewild, New York City's 4,000-acre post-war super-airport now under construction, will have runways up to 10,000 ft. long designed for 300,000 lb. gross plane loading, supported on dual wheels spaced 5 ft. apart.

As civil aviation develops after the war, we may have an age of flivver planes, and if so, the CAA Class I field with runways currently 1,800 to 2,700 ft. and designed initially for 5,000-lb. wheel loads will be called on to perform an important service. But these fields threaten to be seriously inadequate for the network of commercial feeder airlines envisioned, ac-



A 60,000-lb. test load used in the Chief of Engineers' research program.

cording to plane experts. Dr. W. B. Oswald and J. R. McGowan of Douglas Aircraft, in discussing landing characteristics of future planes before the National Aeronautics Association Joint Airport Users Conference last summer made this significant observation: Contrary to the prevalent idea that feeder lines will employ small single-motor craft, they'll need twin-motor planes with a gross weight of 12,000 to 25,000 lbs., calling for runways 3,000 to 4,500 ft. long.

This would require at least a CAA Class II field as to pavement thickness and a Class III field as to runway length as the least we dare build for a field that will serve commercial aviation even as a feeder.

These authorities, furthermore, foresee 45,000 to 50,000 lb. gross loads for 2 and 4 engine main line commercial planes, which will need 4,500 to 6,000-ft. runways.

These figures serve to underscore the uncertainty of the whole question, and the serious importance of functional planning which must precede detailed designing.

From a design standpoint it is interesting to note that heavy plane loads far exceed anything in the highway field, where a 9,000-lb. wheel is still the prevailing legal maximum. As pointed out by Col. Stratton, the 5,000-lb. design wheel load used for the lightest or Class IV Army field for light training corresponds to average heavy arterial highway loads. The

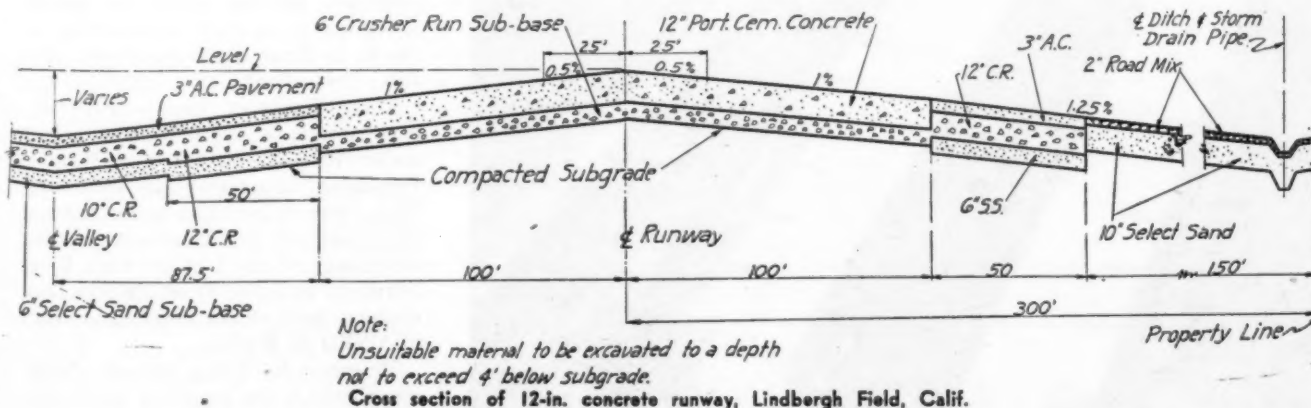
Class III load, 37,000-lb., which accommodates Flying Fortresses, equals the concentration under a heavy freight locomotive. The Class I or 60,000-lb. wheel load represents a 22-yd. 4-wheel scraper 8 times overloaded.

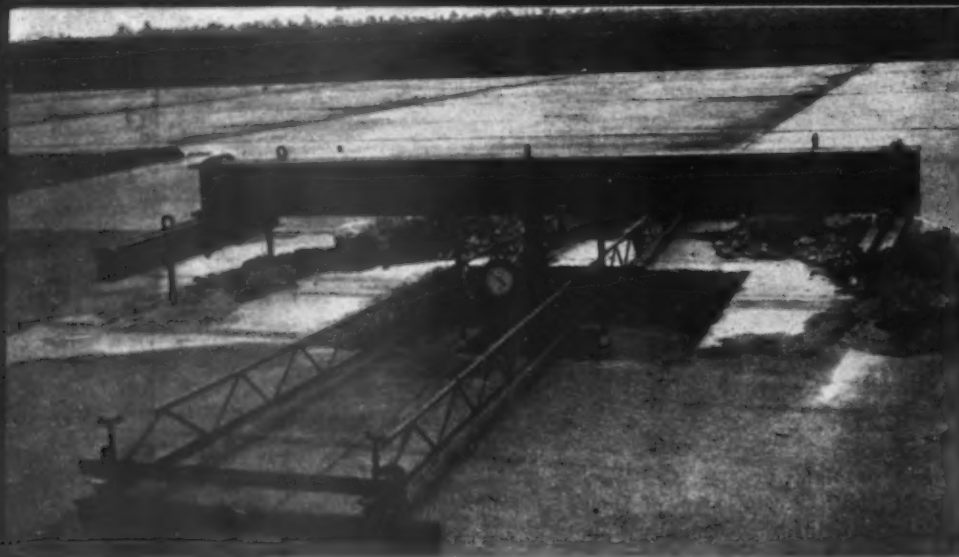
II. Typical Details of Layout, Dimension, Grade

Airfield layouts are governed largely by two considerations, the physical conditions (topography, etc.) and safety. Two and three runway layouts are now well standardized into T, L, X or "Fig. 4" patterns in which runways intersect at right angles and 45° angles, making it possible to land planes within 22½° angle with the wind whatever its direction. Equilateral patterns with runways intersecting at 120° are also suggested in CAA master plans for more elaborate fields.

Safety today on Army fields is provided (1) by trapezoidal approach zones two miles long and allowing 40 to 1 descent; (2) by graded approach zones usually 1,000 ft. long, which provide for emergency landing beyond runway ends and for future runway extension; and (3) by well defined standards of lateral clearance. For runways, side clearance means a 500-ft. width of graded area, 1,000 ft. of ground loop width without obstacles, and a 1,500-ft. zone without fixed obstacles.

As to runway lengths, the range of 3,000 to 10,000 ft. is considered by





Layout of plate bearing test, as used by one U. S. Engineer District on pavement evaluation work in past year. Earth augers were employed for exerting the plate reaction instead of customary loaded vehicles.

plane makers to be adequate for the future of commercial flying. Civil Aeronautics Administration recommended lengths range from the 1,800 to 2,700-ft. bracket for Class I private flier airports, up to "5,700 ft. and over" for Class V or metropolitan airports. These lengths include 100 ft. of unpaved strip at each end. Runways are usually 150 ft. wide.

Grade limits have an important bearing on first cost as well as operation, when it is considered that ordinary 3-runway fields have required from 300,000 to as high as 6,000,000 cu. yd. of excavation.

As to grades, 1.5 per cent is considered the maximum allowable on runways, longitudinal or transverse; 3 per cent the maximum for turfed areas. For very heavy planes, such as 120,000 gross load or over, 1 per cent is the most allowed in Army design and 0.5 per cent is considered desirable. Vertical curve standards are now well defined by the various agencies.

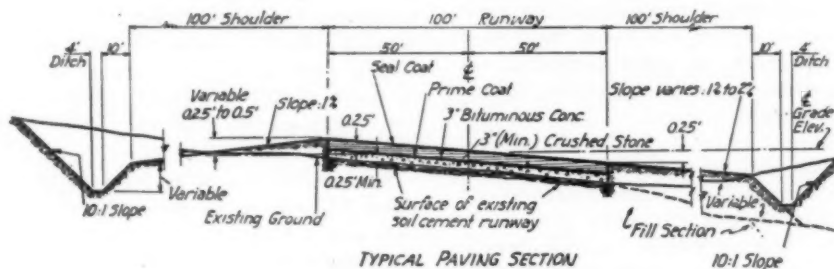
Air view of the Lockburn test track.



Airports and highways are part of what eventually must be an integrated transportation system tying in also with rail lines. Airports built without due regard to highway location may require excessive access road costs, and joint site study may sometimes save enough money on the access roads to equal a large part of the cost of the field, to say nothing of the questions of travel time and convenience of access by road.

III. General Pavement Design Procedures

The Army and Navy published or revised design manuals in 1943 and the CAA early in 1944. While leaving much to the judgment of local or regional personnel these published



TYPICAL PAVING SECTION

This section shows a repaving of existing runways raising the allowable wheel load from approx. 10,000 Lbs. to 25,000 Lbs.

Navy Department design for strengthening a pavement to increase wheel load carrying capacity from 10,000 to 25,000 using a bituminous concrete overlay.

For taxiways 50 ft. is still a prevailing width and longitudinal grades of as high as 2.5 per cent are allowed.

The complex question of site selection and planning will not be dealt with further here except to make a plea for closer cooperation in the future between airport and highway officials in planning airfields which will serve civil aviation.

manuals largely remove design from the "personal theory" stage.

Chief of Engineers Intensifies Studies

The Office of Chief of Engineers realizes that bigger planes and consequent increase in cost and difficulty of airfield construction necessitate continuing large-scale pavement and other design studies. The problem is one of applying lessons learned from the recent rush program, which was based on tentative designs, in order to develop principles of design that will apply to fields for any purpose under any conditions. To this end the Office recently established a Board of Consultants to advise the Office on airfield developments and design problems, and has delegated specific functions to certain laboratories in the U. S. Engineer Department. [See Jan., 1944, ROADS AND STREETS.]

Three Engineer Department Laboratories have recently been given major research tasks: The Flexible Pavement Laboratory at Vicksburg, Miss.; the Rigid Movement Laboratory, part of the Cincinnati testing laboratory of the USED's Ohio River Division; and the Frost Effects Laboratory, part of the Soils Laboratory of USED in Boston.

Progress in Army airport design since 1940 is the result of large-scale

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and broadly conceived experimentation, study of the experiences of other agencies, and close liaison with the Army air forces. Investigations have included experimental tests to determine the effects of load repetitions on various pavement types and thicknesses, which have led to the tentative adoption of design curves and the correlation of test data to check their accuracy.

Other Agencies Also Looking to Future

The agency for Navy airfield design is the Design Section of the Bureau of Yards and Docks. Its trend too is toward heavier sections and larger runways and much of its 1944 program involved strengthening existing pavements due to decreased demand for training fields operating light planes. At present design requirements for Navy fields are undergoing close study with a view toward establishing new requirements for larger planes.

Naval design officials feel that because of the many variables entering into airfield design it would be unwise to set up too rigid standards. An attempt has been made to consider each field as a separate problem, and arrive at a pavement design which would best satisfy local conditions, materials, soils and climate.

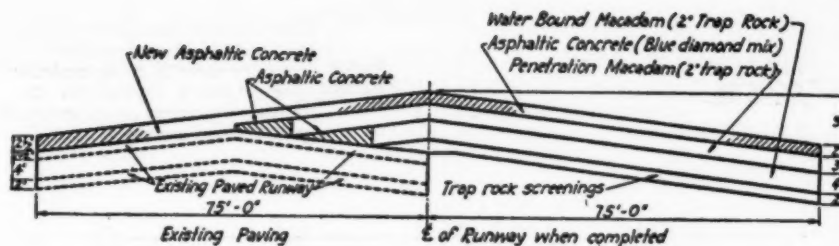
The Civil Aeronautics Administration, which has nearly completed a \$400,000,000 program involving 650 airports, constructed or let 105 airport projects in 1944, most of these being designed for 37,000-lb. wheel loads, corresponding to Army Class III fields. Its design methods likewise are being constantly revised.

Procedure Used in Soil Classification and Subgrade Evaluation

It is my purpose here to briefly highlight and compare the current Army, Navy and CAA design methods: In this connection, may I pay tribute to the Public Roads Administration for its helpful publication, "Principles of Highway Construction as Applied to Airports, Flight Strips and Other Landing Areas for Aircraft." It has made available to all the benefits of a vast amount of soils and pavement experience.

Each agency has developed its own approach, contrasted roughly as follows:

1. U. S. Engineers have based flexible pavement designs on the bearing power of the subgrade as determined by the California Bearing Ratio test.
2. The Navy's procedure is based more generally on behavior of trial sections using bearing tests.
3. CAA's approach is to design in accordance with a special classification



TYPICAL SECTION THRU RUNWAY WHICH IS TO BE WIDENED & REINFORCED. SECTION TO RIGHT OF ϵ IS TYPICAL OF NEW RUNWAY DESIGN.

How new pavement layers were dovetailed into old, in widening a runway. Rentschler Field, Hartford (Pratt & Whitney).

of the subgrade, for which a well defined procedure including its own experience curves was set up and issued in manual form in April, 1944.

IV. Flexible Pavement Design

Surface—Army practice calls for 1½ in. minimum bituminous pavement for wheel loads up to 15,000 lb., 3 in. min. loads up to 37,000 lb., and not exceeding 6 in. for heavier loads, with 90 to 95 per cent theoretical density depending on the type. Bitumens should be selected for ability to remain soft and pliable or non-cracking under infrequent traffic kneading.

The Navy Bureau of Yards and Docks specification, which is typical, calls for the following minimum thicknesses to resist torsional and tangential stresses under moving tires.

The CAA has sometimes used special asphaltic mixes for the last 200 ft. at runway ends, the purpose being to afford greater torsional resistance under locked wheel turns. An additional ½ in. of thickness is sometimes specified in these areas (say 2½ in. as against 2 in.) and 100 per cent crushed stone aggregate is required as against a minimum of 40 per cent crushed for other parts of the runway, and more roller passes are required to get 94 per cent as against 92 per cent compaction. (In other instances, concrete is sometimes used for end sections of bituminous runways by all agencies because of torsional turning stresses and because of frequent landing impact.)

Base and Sub-base Design for Flexible Pavements

Each national agency has also developed its own way of arriving at a

Table of Minimum Asphaltic Surfacing Requirements

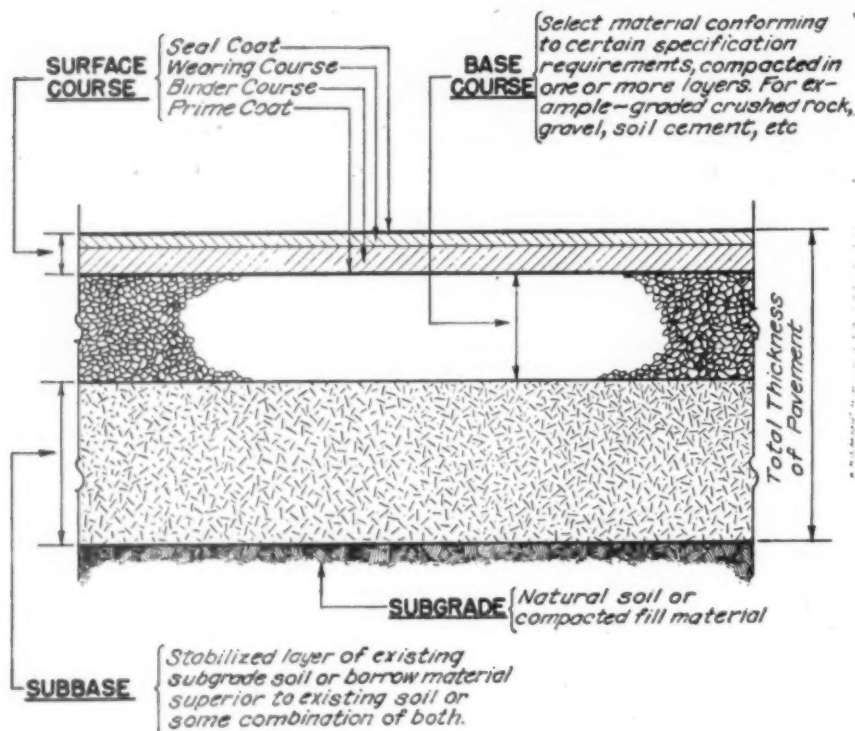
Wheel Load Pounds	Total Thickness of Surfacing Inches	Thickness of Binder Course Inches	Thickness of Wearing Course Inches	Types
15,000 or less	2	2	Cold or hot-laid, cutbacks, emulsified asphalt or asphalt cement.
15,000 to 25,000	2½	None or 1½	2½ or 1	Densely graded aggregate, hot-plant mix, hot-laid, asphalt cement.
25,000 to 50,000	3	1½	1½	Densely graded aggregate, hot-plant mix, hot-laid, asphalt cement.
50,000 or more	4	2½	1½	Densely graded aggregate, hot-plant mix, hot-laid, asphalt cement.

The thickness of topping is considered as an added factor of safety against excessive settlement in Navy design.

Road mix and other low type surfaces have little or no place in airports except for temporary or infrequently used fields. Dense-graded, hot-mix asphaltic concrete is specified on major airports, while either cold or hot-laid mixtures using cut-back, emulsified asphalt or asphaltic cement are permissible on fields for lightest planes. One or two courses are used, depending on the loading and type of mix. Rock asphalt, sand asphalt and other materials have found a place.

flexible pavement design. While resulting in fairly similar solutions, they are distinctly different. All rightly treat base design as an economic problem, in which various combinations of local and imported materials, natural or processed, are utilized in sufficient combined thickness to give a specified load carrying capacity.

U. S. Engineer Method—This agency in 1940 decided that flexible pavements, designed on the basis of subgrades rated at deflections commonly considered acceptable before the war, were not satisfactory for present-day airplane loadings. No

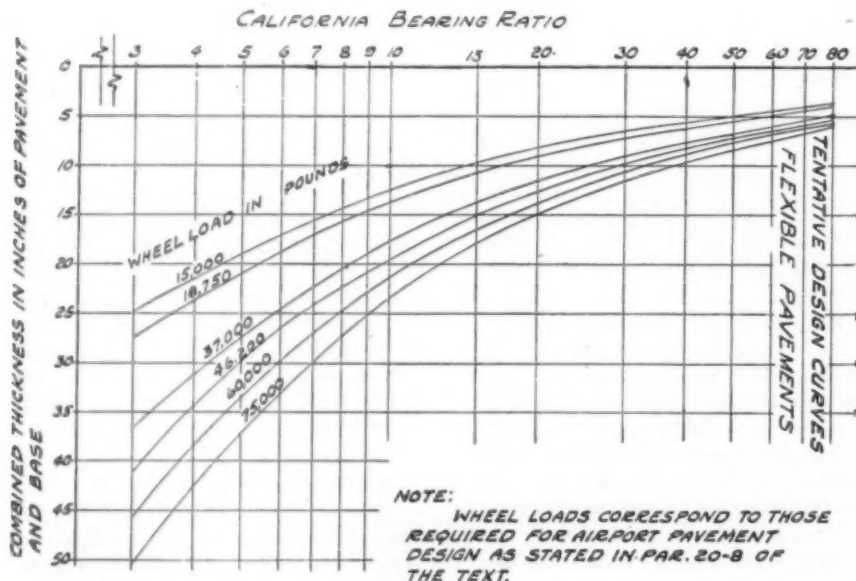


Navy terminology on elements of a flexible pavement.

sure procedure for determining subgrade bearing capacity had been developed. It was seen that development of a satisfactory test procedure based on any existing formula would take a long time; that plate tests depended on many assumptions and variables not always easily determinable; and that it would be extremely difficult to develop any method satisfactory for adjusting test results to moisture conditions that would eventually develop under a pavement.

Employment of plate bearing tests on pavement surfaces was also investigated. And even greater difficulty was seen in properly interpreting the results of such tests.

After study the Office decided to adopt the so-called California Bearing Ratio principle as the design basis for the duration of the war or until a better principle should be developed. This principle consists of determining a modulus of the shearing strength of the subgrade soil by a test, and using



Corps of Engineers experience curves based on California Bearing Ratio for selecting total thickness of bituminous pavement.

the modulus with empirical curves developed by pavement service studies, to determine the required combined thickness of base and pavement. Present procedures and limitations of the CBR* test were established by research. According to a Chief of Engineers spokesman it is still necessary to correlate the laboratory findings with similar studies of soils compacted by field methods. Investigations to obtain the necessary data are being organized.

With the help of accelerated traffic tests, using heavy plane wheel loads, California Highway Department curves based on highway experience were extrapolated, and tentative design curves applicable to airfield pavements were prepared by consultants and the Chief of Engineers' personnel. These curves in turn were substantiated by accelerated traffic tests on existing pavement at four Army airfields in widely scattered regions, and at a test project at Stockton, Calif. Incorporated in Chapter XX of the Chief of Engineers Engineering Manual, issued in June, 1942, this method has since been used in the design of all USED pavements. To refine the curves, more accelerated traffic tests were made on specially constructed test sections at Barksdale (La.), Langley (Va.), Elgin (Fla.) and Grenier (N. H.) fields. At the present time it is considered that no further testing of special sections will be required to obtain design data for wheel loads less than 60,000 lb. Studies of airfields in service will yield the desired information. But a special 800 x 40 ft. test section, to be tested with a wheel load of 150,000 lb., is being constructed at Stockton, Calif., in order to furnish data for design curves beyond present limits.

The necessary combined thickness of pavement and base course, based on the CBR test of subgrade, is taken from the chart shown at left. This thickness allows for conditions of saturation, stress repetition and other influences, excepting frost action, for which added thickness is necessary. For limited operation fields the army practice is to reduce the values by 20 per cent. This curve can be used

*The CBR test is mainly a penetration test (shear test) used to determine the modulus of stability of the soils used under flexible pavements. A soil's CBR is its relative stability as determined by this penetration, expressed as a percent of the stability value of a selected crushed stone. CBR tests are also made of the undisturbed soils under existing pavements to determine their carrying capacity. The modified AASHTO compaction test is used in conjunction. Soon after adoption of the CBR test, in order to utilize available equipment and obtain specified densities, the test was revised to use a compaction method similar to that adopted for field compaction control tests (modified AASHTO).

to compute the thickness of material needed above each of several base course layers, thus permitting the utilization of varying types of materials layered in the most economic combination of thicknesses. If a high CBR material is used for full depth of base, less total thickness may be necessary and studies are in progress to determine if the present CBR design curves can be modified for this circumstance.

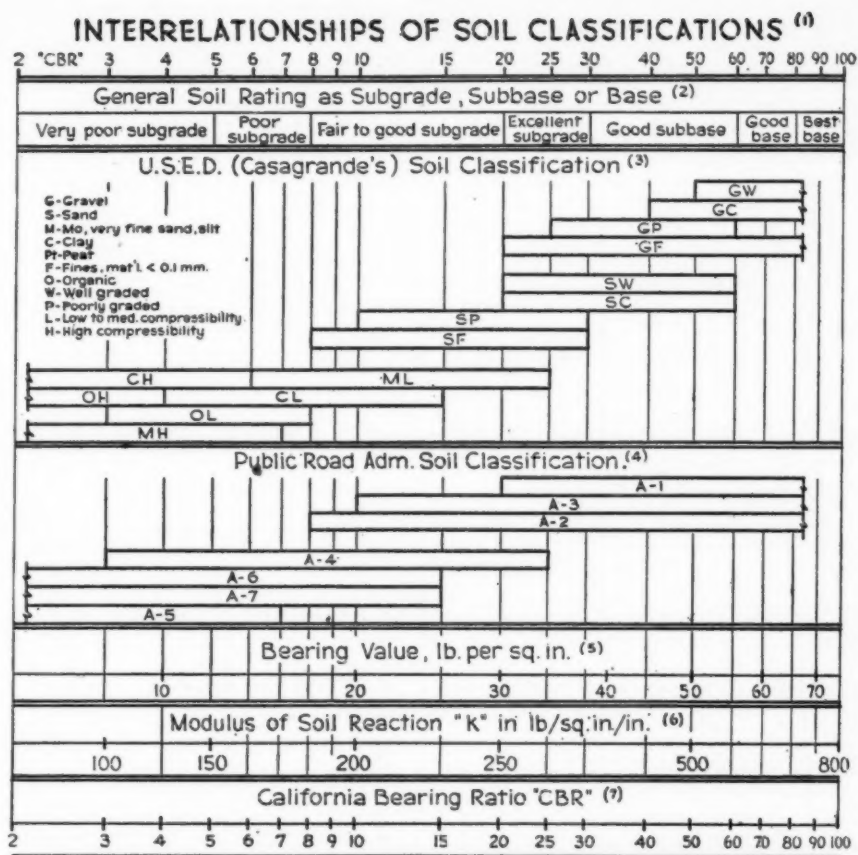
A CBR of 80 per cent or more, such as is obtained with soil-cement or sufficiently good granular material, is desirable immediately under an arterial highway pavement. But material of lower CBR can usually be permitted directly under flexible air-field pavements where 80 per cent material is not locally available. For the top 6-in. base layer, present Engineer Corps specifications call for 50 per cent allowable CBR for gross plane loads 10,000 to 30,000 lbs., 65 per cent for loads of 30,000 to 74,000 lb., and 80 per cent for planes of 74,000 to 120,000 lb.

In classifying soils both Navy and Army authorities use the Casagrande classification in preference to the Public Roads Administration A-1 to A-8 classification. The CBR laboratory test is used in conjunction with classification tests as a means of differentiating between soil types and in estimating the relative stability of different soil types and soil mixtures.

Flexible Pavements; Navy Procedure—In deciding flexible pavement thicknesses, the Navy Bureau of Yards and Docks prefers to rely on soil loadings. Design is based on a limiting value for deflection when the applied load is equal to the maximum anticipated wheel load. This load is applied through a circular steel plate on a trial section of pavement without the surface course, the plate area equaling that of the tire contact for the greatest wheel load. The limiting value is 0.2 in., a value agreed upon by the Committee on Flexible Pavement Design of the Highway Research Board in Nov., 1942. Using a tire rigidity factor of 1.1, for example, a 40,000-lb. design wheel load at 80 lb. tire pressure gives 455 sq. in. tire contact, equivalent to the area of a 24-in. plate.

Trial test sections 20 x 20 ft. are used. As a first approximation, a total thickness is assumed, exclusive of surface or wearing course, about equal to the radius of the circular plate, or in this instance, say, 12 in. If the selection of this thickness of base and sub-base exceeds or is less than 0.2 in., a second test section is made thicker or thinner, accordingly.

In order to reduce the time and



- (1) All interrelationships are very approximate. Actual field and laboratory tests are required to determine "k", CBR, and bearing values.
- (2) See "Foundations for Flexible Pavement" by O.J. Porter, 22nd An. Mtg Highway Research Board, 1942, for basic idea.
- (3) See Engineering Manual, Chapter XX, March 1943, War Dept., Office of the Chief of Engineers. See also, "Soil Tests for Design Runway Pavements," by Middlebrooks & Bertran, 22nd An. Mtg H.R.B., 1942.
- (4) See item (3). A-6 and A-7 soils cut off at CBR=15, rather than 25 as indicated in Chapter XX.
- (5) See second reference of item (3), page 184. Bearing values measured at 0.1 in. deflection. Bearing plate area not given.
- (6) See item (3). "k" is factor used in Westergaard's Analysis for thickness of portland cement concrete.
- (7) See items (2) and (3).

How Casagrande soil classifications compare with PRA A-1 to A-8 groups. The Casagrande grouping is used by Army and Navy designers.

labor consumed by constructing and loading numerous trial sections, Navy designers make use of a curve of settlement (see page 74). Using the value of "S" obtained in the loading of the first trial section, with the values of P, a and F used in the

first trial, the formula $S = \frac{Pa}{C} F$ is

solved for C. This value of C and a value of S = 0.2 in. are then used in the formula to obtain the new value

of F. From the curve the value of —

a for this new F can be obtained which gives a new thickness.

A second trial pavement is then constructed to this thickness and loaded. If the measured deflection of this second trial section is appreciably less than 0.2 in., a second computation is made and another section is loaded.

Redesign of Failed or Inadequate Flexible Pavement—As stated by Navy officials, it is necessary here to

distinguish between failure of the pavement as a whole and failure restricted to the surface. The first type of failure indicates overload; the second, abrasion or tearing action of moving wheels. An important corollary problem in correcting pavement failure often is to improve drainage. If deflection tests show that heavy loads can be sustained without settlement greater than 0.2 in., then the problem is simply one of surfacing.

Standard practice in strengthening bituminous pavements with a new bituminous surface is to first cover it with a suitable well graded granular material, so that both the necessary total base thickness and surface run-off slopes are provided. Where a concrete overlay is decided on it can be placed directly over the old surface if adequate transverse drainage slopes are present. Otherwise a leveling course is necessary.

Sometimes, due to need for slope correction, removal and entire re-

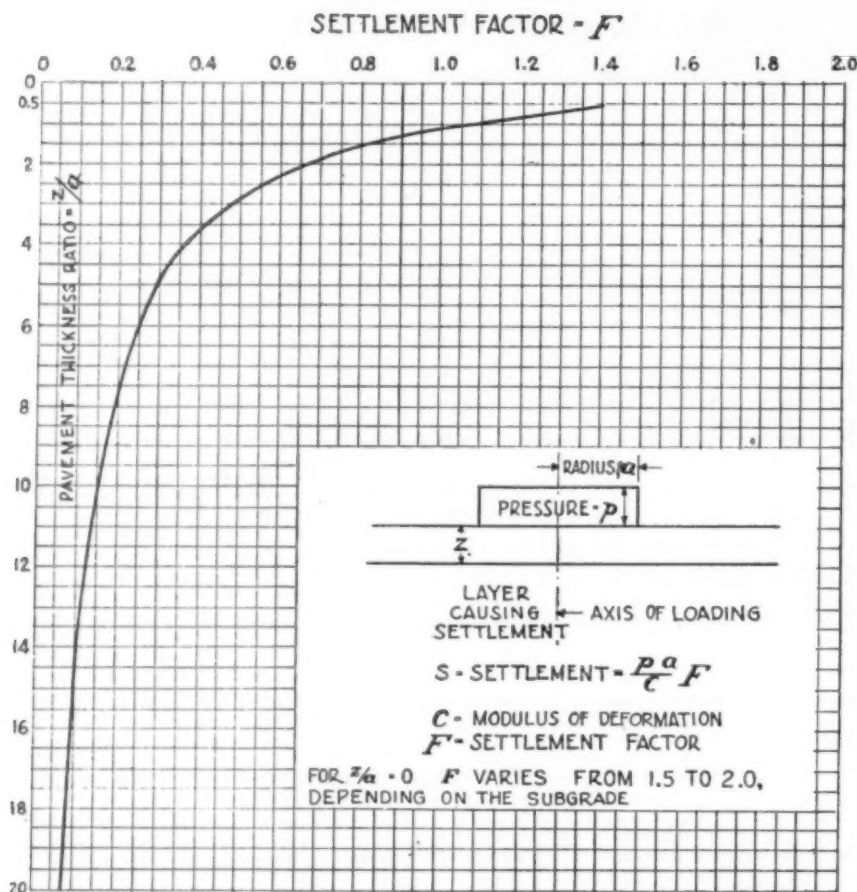


FIGURE 1—SETTLEMENT UNDER CENTER OF
UNIFORM CIRCULAR LOAD

Settlement factor experience curve used by Bureau of Yards and Docks in designing flexible pavements.

construction is the answer. Each field must be studied individually.

Stage construction is easily handled with bituminous materials. This involves the usual brooming and tack coat of RC-2, RC-3 or RC-4 asphalt.

CAA Flexible Design Procedure

Soils Classification—The Airports Division and the Airways Engineering Division jointly issued design manuals early in 1944 which represented notable design progress. The present design method, used for both flexible and rigid pavements, is result of wide investigation. It is based on a special soils classification, called E-1 to E-10. These bands are a little more rigid and each E type falls into a more definite category than for other existing classifications, in the belief of CAA engineers. The CAA also uses the CBR test as one criterion, however. Finding soil characteristics under this classification requires thorough field investigation and careful sample selection. CAA experience has shown the necessity of beginning the soils investigation early and of personally observing soils of the airport locality under all weather conditions. Minimum tests required are: Mechanical analysis, liquid limit, plasticity index, volume change, capillary rise, and CBR.

Using results of these tests the soil is then classified by means of the table (shown below). Note again that the classification of a soil depends on the mechanical analysis, plasticity

Soil	Material Passing #10 Sieve			Material Passing #40 Sieve			Capillary Rise of Minus 10 Material	Coll. Bearing Ratio (Sealed)	Subgrade & Subbase Classification			
	Sand %	Silt %	Clay %	Liquid Limit	Plasticity Index	Volume Change At FME			No Frost Good Drainage	Severe Frost Good Drainage	No Frost Poor Drainage	Severe Frost Poor Drainage
E-1	85+	0-10	0-5	25-	0-6	0-6	0-12	20+	F ₈ R ₁₀	F ₈ R ₂₀	F ₈ R ₁₀	F ₈ R ₂₀
E-2	75+	0-15	0-10	25-	0-6	0-6	0-36	20+	F ₈ R ₁₀	F ₈ R ₂₀	F ₁ R ₁₀	F ₂ R ₂₀
E-3	55+	10-40	0-20	35-	0-10	0-10	36+	18+	F ₈ R ₁₀	F ₁ R ₂₀	F ₂ R ₁₀	F ₃ R ₂₀
E-4	55+	10-30	5-25	45-	5-15	5-15	36+	13-40	F ₁ R ₁₀	F ₂ R ₂₀	F ₃ R ₁₀	F ₄ R ₂₀
E-5	65-	20-75	0-20	45-	0-10	0-15	36+	9-20	F ₂ R ₁₀	F ₃ R ₂₀	F ₄ R ₂₀	F ₆ R ₂₀
E-6	55-	5-70	10-40	50-	10-30	10-30	36+	6-12	F ₃ R ₁₀	F ₄ R ₂₀	F ₆ R ₂₀	F ₇ R ₂₀
E-7	55-	5-70	15-50	60-	15-40	20-40	36+	4-8	F ₄ R ₁₀	F ₆ R ₂₀	F ₇ R ₂₀	F ₈ R ₂₀
E-8	55-	5-50	30+	70-	20-50	30-50	36+	3-5	F ₆ R ₂₀	F ₇ R ₂₀	F ₈ R ₂₀	F ₉ R ₂₀
E-9	55-	5-50	30+	80-	30-60	40-60	36+	2-4	F ₈ R ₂₀	F ₉ R ₂₀	F ₉ R ₂₀	F ₁₀ R ₂₀
E-10	55-	30-80	30-	60+	0-25	—	36+	1-3	F ₉ R ₂₀	F ₉ R ₂₀	F ₁₀ R ₂₀	F ₁₀ R ₂₀

Chart 1 soil classifications, used by the Civil Aeronautics Administration in designing flexible pavements.

characteristics and expansive qualities (Atterburg limits) and CBR. Thus physical characteristics and bearing quality are both indicated as an aid to proper rating. The CBR is also helpful in correlating results with those of the Army engineers and other agencies now widely using that test.

Briefly, the CAA's classification falls into two groups. E-1, 2, 3, and 4 are granular soils, and E-5 to 10 are non-granular soils. The granular soils are further divided into non-frost heave (E-1 and E-2) and soils subject to frost heave (E-3 and E-4). The E-1 soil is a free draining, non-plastic sand corresponding to the PRA classification A-3. The E-2 soil is a sand containing slightly more silt and clay than the E-1. The E-3 corresponds to a non-plastic and moderately plastic PRA A-2 type and the

E-4 is equivalent to the PRA A-2 plastic type.

Symbols shown in the last four columns of CAA's table are used to reflect the soil properties with or without frost and with good or poor drainage. An E-1 soil is an estimate of a soil that requires no sub-base under conditions of severe frost and poor drainage; and E-3 soil is an estimate of the poorest soil on which a base course could be placed under the most favorable conditions of no frost and good drainage.

CAA Flexible Pavement Design. The next step with CAA is to pick design thicknesses from charts based on experience gained in building some 200 airfields and other available data. Giving total thickness for normal use under a given design load, there are charts for bituminous bases, non-bituminous bases such as dry choked macadam, and emulsified asphalt

bases. Although different combinations of base and sub-base thickness may be indicated, each chart gives the same total thickness of base and sub-base. For example, design Chart 3 (below), for E-4 soil under poor frost and drainage conditions (F-4 classification), and for a 74,000 lb. gross load, would call for 8 in. of sub-base, 9 in. of non-bituminous base and 2 in. of surface, or 19 in. total.

Using CAA design chart 4 (not shown), the same soil would require 12 in. of sub-base, 5 inches of bituminous base and a 2-in. topping. Using Chart 5 (also not shown) for emulsified asphalt, the combination would be 10 in., 7 in., and 2 in.

Designs based on this method agree closely with designs arrived at by Army or Navy procedures. These curves are considered subject to possible revision as more service data become available.

Chapters V and VI of Mr. McKeever's foregoing paper, "Where We Are in Airport Design," covering Concrete Pavements and Drainage, will be published in an early issue.

Minnesota State Highway Equipment Costs

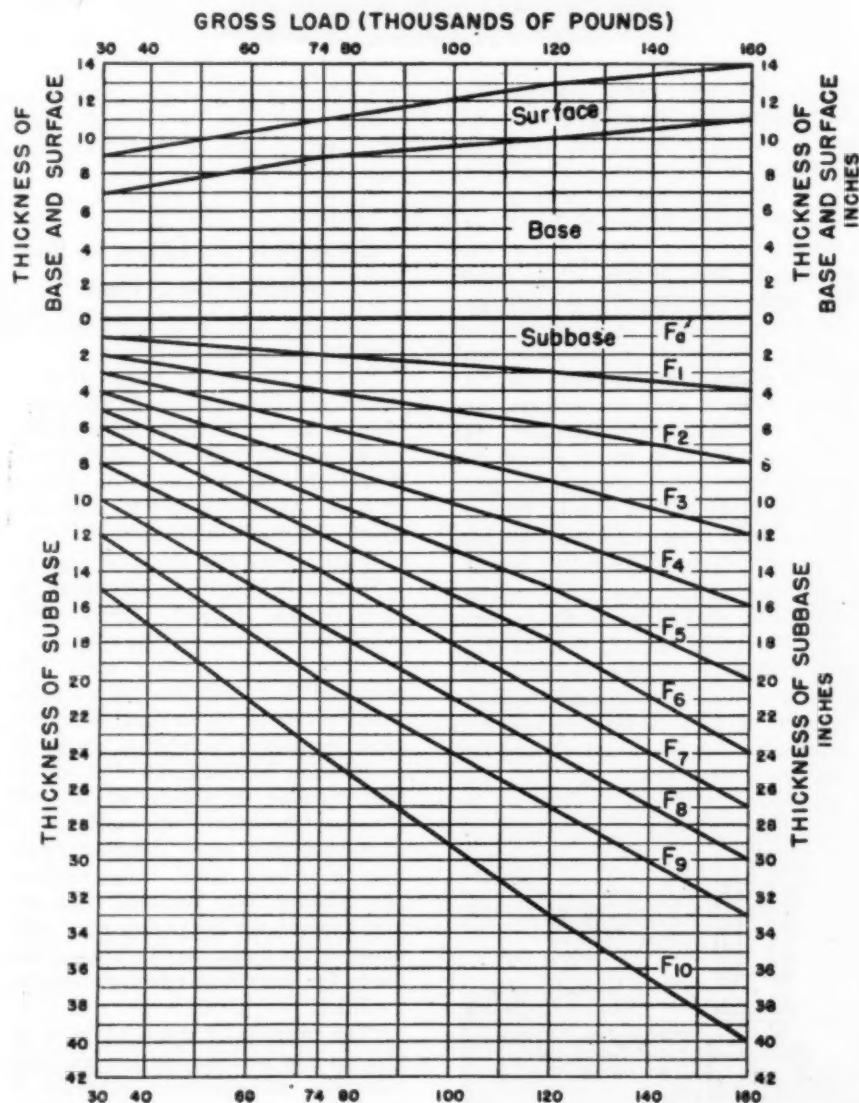
The total over-all costs charged against Minnesota trunk highways for the use of state-owned equipment during each of the past four fiscal years is given below:

1940-1941	\$1,844,144
1941-1942	1,526,667
1942-1943	1,606,153
1943-1944	1,312,723

The above costs include all material and labor for repairing equipment, all fuel and lubricants for operation, and equipment depreciation charges, as well as all charges made for equipment housing facilities.

The 1942-44 Biennial Report of the Minnesota Commissioner of Highways, from which these figures were taken, states, "Due to the need for replacement of much old equipment and the building of additional facilities for housing and maintaining equipment, it is expected that as soon as war restrictions are relaxed, extensive purchases will be made of new equipment and extensive expenditures will be made for housing facilities."

Traffic Fatalities in New Jersey Decline—Traffic accident fatalities in New Jersey in 1944 were the lowest since 1922. The total last year was 609.



CAA's Chart 3, used to design flexible pavements having non-bituminous base. Not shown are similar charts 4 and 5 involving bituminous and emulsified asphalt bases.

Timber Trusses Built with Salvage Rail in Lower Chords

A RESOURCEFUL bit of designing to eliminate critical materials was observed on five timber truss bridges in New Mexico recently. In replacing old wood trusses on the Pecos Canyon secondary road near Santa Fe, a truss design was developed which utilized creosoted timber for upper chords and compression diagonals, the steel hangers from the old bridges for verticals, and salvage rail for the lower chords.

The trusses consist of five 15-ft. panels. Two parallel lines of rail were employed for each chord, with welded splices at the third points. Rail was specified to be not lighter than ASCE 4040. Short lengths of rail were used for end post reinforcement and as bridge shoes, as shown in Fig. 1, which also shows detailing of diagonal chord connections.

Floor beams consisting of two 8x18's were suspended on castings at the bottom of vertical rods, and the floor built up with conventional laminated wood-stringers and planking.

The contractor, Skousen Bros., was

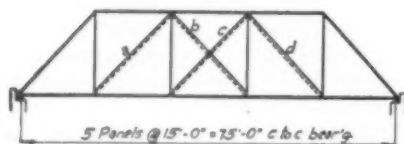


Fig. 2. Sequence of erection (see text)

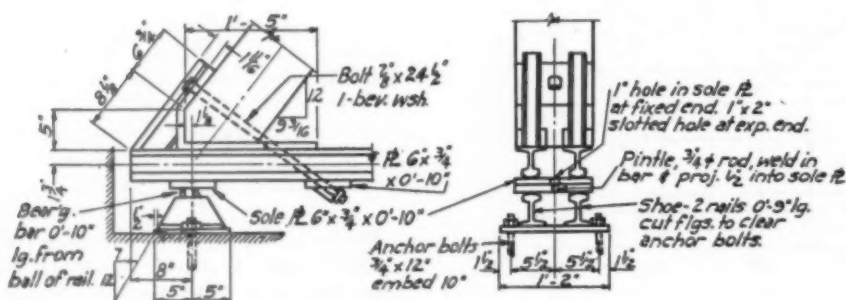
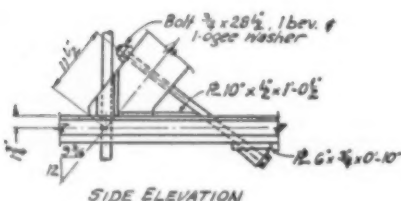
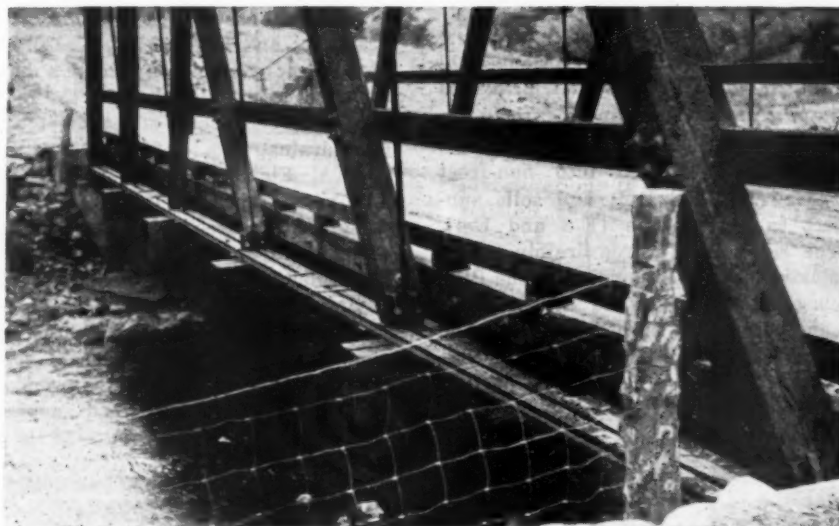


Fig. 1. Details of chord and end post connections showing use of old rail



represented by Frank Limbaugh of Albuquerque, in erecting these spans and did so with minimum equipment by following the sequence sketched in Fig. 2. (1) After first completing concrete abutments, falsework bents were placed under each panel point and intermediate floor beams set in place. (2) Rails were laid in position and the splices welded. (3) Inner diagonals a and b were erected along with bottom connections, making an "A" frame, then c and d members, and these members braced laterally. (4) Top chord timbers were placed full length, then end posts and hangers. For the 10x10-in. top chords, the contractor used single timber 47 ft. long in preference to splicing two pieces.

The timber trusses replaced had been built many years ago by the U. S. Forest Service. It is interesting to note that in rebuilding the rotted floor system in 1931, continuous 10 in. x 10 in. x 76 ft. timbers had been substituted for the usual spliced bottom chord members.

F. G. Healy is state highway engineer, E. B. Van De Greyn is bridge engineer of the New Mexico state lighting department.

CAA Advises Cities to Buy Airport Land Now

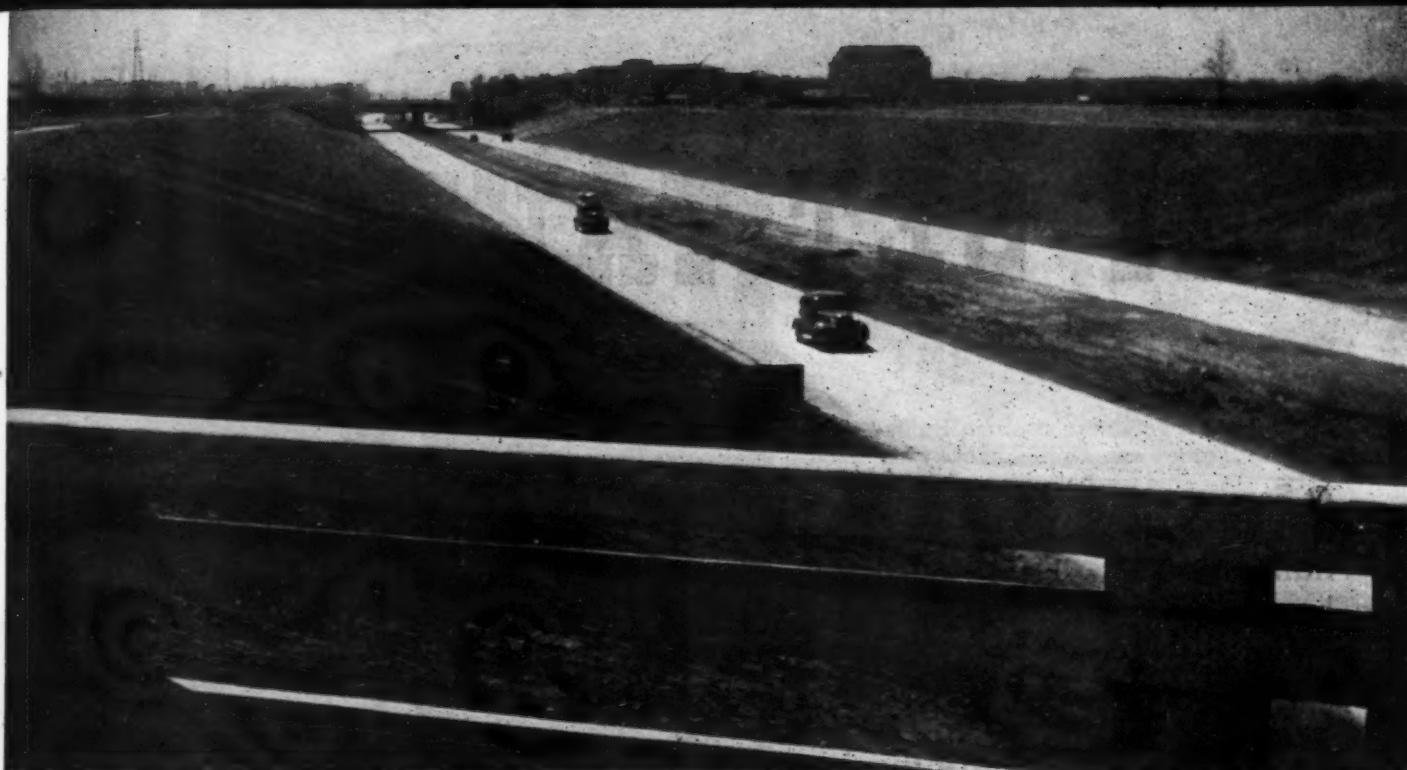
"Get your airport acreage now, before the rush starts."

This is the advice being given to American cities by the Airports Service of the Civil Aeronautics Administration, pointing out that postwar demand for vacant land in the suburbs of cities and towns will be intensified by the requirements for housing.

While Congress debates the five bills now before it, which would implement the National Airport Plan submitted recently by the CAA, communities are continuing their local planning for airports. The CAA could not base its national report on local surveys, which must await appropriation by Congress of funds for that purpose, and each of the bills proposes immediate appropriation of \$3,000,000 for more detailed examination of local sites. City engineers are working with regional CAA airport supervisors and their states' aeronautical organizations in studies and plans for providing adequate landing facilities.

"The function of the CAA is to advise on the location, design and construction of airports," Charles B. Donaldson, Director of the Airport Service, CAA, said recently. "It is

(Continued on page 90)



Looking along the newly completed depressed roadways of Detroit Industrial Highway [construction features reviewed in "Roads and Streets," Aug., 1944]

Detroit's New Industrial Expressway Opened



FORMAL opening of Detroit's new industrial Expressway, linking the city with the Willow Run Expressway, took place March 9 with many notables attending the traditional ribbon cutting.

Conceived and built as an aid to the war effort, this 38.3-mile, 26-million-dollar project affords a preview of latest postwar expressway design practice for metropolitan centers. Linking the great Ford River Rouge plant, Willow Run Bomber plant, and other industries between Detroit and Ypsilanti, it consists of a limited access system of dual highways of two to four lanes each, depressed as it nears the city. Included are two stream bridges, 11 rail and 43 highway grade separations, several of which involve elaborate interchanges.

Dedication: Hy. Comm. Chas. M. Ziegler,
Lt. Gov. Brown, Henry Ford II, Dep. Comm.
Harry T. Ward

Two ready-mix trucks dumping side-by-side helped speed completion. Calcium chloride was used in the mix

Unique 3-level grade separation on Willow Run Expressway, part of new 38-mile system



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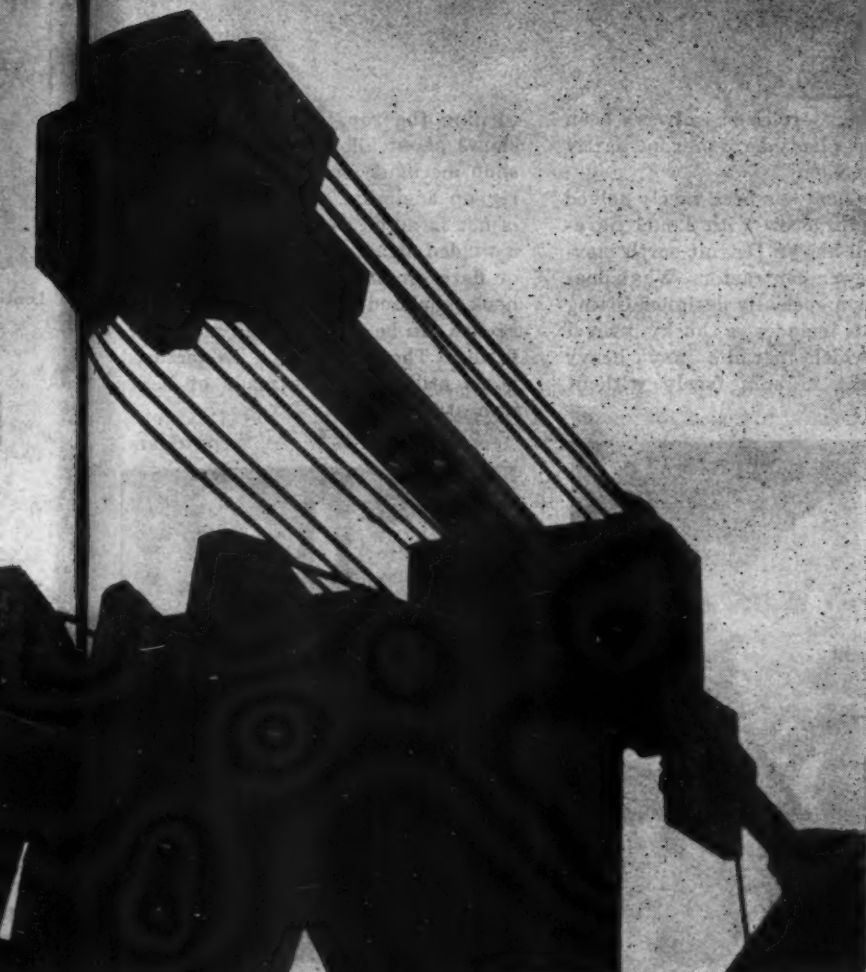
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"WELCOME TO BURMA ... COURTESY OF THE HAIRY EARS"

"The Army Engineers are doing a big job in India. They are building a new route through Burma to replace the old road long since captured by the Japanese.

"Built as only American engineers and machines can do it, this new route crosses India's eastern border, crawls along her valleys and winds snake-like up the Himalaya slopes. It traverses malaria-infested valleys, then rises to 4,000-ft. elevations.

More Modern Methods than on Burma Road

"The new road is an example of American genius. The Army Engineers here put road building on a mass-production basis. When they sent a machine ahead to do one job they never let it come back over the same piece of road the second time.

"The 'Hairy Ears' moved in through the tea fields into India's Assam Province. They set up their advance camps, unloaded machinery, worked seven days a week through incessant rain and temperatures that soared to 130°,—and griped to the high heavens as good soldiers will. With grim humor one corporal named his bulldozer, with neat white letters, 'My Assam Dragon.'

"The supply of wire rope was most important, because cable-controlled machines were doing all the work. American-made preformed improved plow steel rope gave long-life through its ability to resist bending fatigue and drum crushing. These engineers found that preformed sometimes far outlasts non-preformed. Supplying it on the new Burma Road no doubt saved both time and valuable cargo space in the ships which had to transport it."



Some machines are necessarily designed with small sheaves and reverse bends. PRESET capably withstands the punishment imposed by such conditions.

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Swivel Bearing Keeps Suspended Skull Cracker from Twisting Rope

When a heavy pavement "buster" is picked up with a crane it invariably spins around a few times, which soon twists the life out of the hoist rope. Because of the great inertia of a 2,000-lb. mass, it isn't practicable to try to hold the critter from turning, and

skull cracker service has always been regarded as plenty hard on rope partly for that reason.

This problem has been nicely solved by the repair crew with Louis Garavaglia, well known Detroit earth moving and sewer contractor. What does the trick is a specially designed lifting clevis that includes a husky swivel bearing which permits any heavy lifted object to spin freely without

turning the rope with it. The photo shows about all the detail any handy shop mechanic or welder will need to rig up a similar clevis. The bearing is not in sight, being covered over by a welded strap. It consists of a taper or flare on the top end of the lifting hook, enclosed in a socket into which grease can be shot through a pressure fitting. The upper part, as pictured, is an ordinary clevis made of heavy iron straps.



Timber Bridge Truss Repaired With Concrete Bearing Blocks

A resourceful emergency means of extending the life of an old timber truss north of Quincy, Calif., is reported by Jason Howe, associate bridge engineer, Calif. division of highways. Reinforced concrete bearing blocks were installed as pictured, enveloping the steel vertical rods and functioning to carry the thrust between the timber lower chord and web members of the 114-ft. span trusses. The original timber bearing blocks had been crushed by pressure of the web members, causing sagging and eminent failure.

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The concrete blocks were decided upon after considering the difficulty of getting select grades of timber blocks of suitable size, and of fitting new blocks and inserting the hanger rods none of which were to be dismantled. In order to do the job without traffic interruption the deck and upper chords and lower chords were supported on temporary bents at each panel point. Web members were then blocked into place and the timber bearing blocks split and removed. The

"Whiffenpoof" Straw Spreader

Aids Airport Dust Palliation Job

AFTER experimenting with various methods of eliminating the dust hazard on bare areas of new airport grade, the U. S. Engineers of the Sacramento District have worked out a routine of spreading and discing straw into the ground surface. And so was born the particular model of special-purpose straw spreader pictured.

Known locally as the "whiffenpoof," the complete machine, mounted on a heavy trailer, weighs approximately five tons. Provision is made to tow this equipment behind a heavy truck loaded with bales. As the bales are pushed from the truck to the spreader, they are picked up on a conveyor and slowly hoisted to a hopper at the top of the machine. Here the teeth of a whirling drum shread the straw from the bale and drop it into a second hopper. From this, the loose straw falls onto the spinning spreader disc, which distributes it in a swath 25 feet wide. The mechanism is driven by a built-in 6-cyl. Ford engine.

trusses were lifted back into proper position with hydraulic jacks.

Then reinforcing rod assemblies were put in position, forms built around truss members, tie rods wrapped with two layers of asphalt paper, and concrete tamped into place. Result O. K. to date. C. C. Gildersleeve was contractor; Roy Fetter, res. engr.

Traveling at 4 mph., this machine can spread straw at the rate of an acres in 12 min. or less. Operation of the complete truck and spreader unit requires three men. This unit is followed by a tractor-drawn disc harrow, weighted with concrete blocks and so aligned that it does not turn the soil but rather cuts into it to a depth of

3 to 4 in. In this operation the loose straw, normally in strands up to 18 in. long, is bent or folded and pressed into the ground, the ends sticking up and forming miniature stubble rows 8 in. apart.

These straw "hedges" are obstacles to rolling dust particles and in addition so reduce wind velocities at the ground surface that even should a stray grain of dust get to rolling rapidly, the retarded wind would not carry it off the ground.

The cost of this dust treatment runs about \$130 per acre, which is considered a good investment in view of the damage dust may cause to a \$20,000 bomber engine.

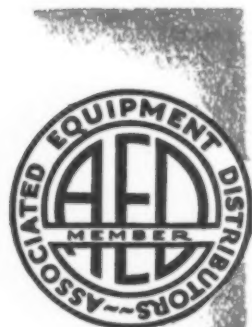
Triangular Apron Concreted from Paver Set Up as Central Plant

By MAXWELL F. THIEL
Asst. Engineer, Soils Laboratory
U. S. Engineer Department
Los Angeles District

Mixing of concrete in a stationary, centrally located 34-E dual drum paver and delivery of concrete by six dump trucks, was the method used in paving a big parking apron at the Army's Modification Center No. 2 located in the southwest. Pierson, Dickenson, Oswald and Casson Construction Co., of Phoenix, Ariz., were the contractors on this USED project (Los Angeles Dist.).

The apron in question is triangular, 960x1060x1500 ft. on the three sides, and required 62,000 sq. yd. of 9-in. concrete, plus 548 tons of asphalt and 548 tons of bituminous mix. The central plant set-up was adopted in preference to usual lane-by-lane paver operation in order to get concrete to the paving spot most expeditiously





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throughout the triangular area, which involved 25 ft. lanes parallel to the base of the triangle and graduated in length from 900 ft. down to 10 ft.

In addition to the 34-E dual, the mixing plant included a batch plant and a conveyor belt. The hopper was removed from the paver, and aggregate and cement were carried from the weight-box of the batch plant directly into the paver on a conveyor belt. Concrete was dropped directly into 2-batch dump trucks. The mix in general was controlled to keep the slump within a range of 1 to 2 in. in order to avoid segregation in transit. The success of using this dry mix was shown by the fact that although some of the hauls were as much as a quarter of a mile, the materials did not separate appreciably.

Concrete was deposited from the trucks and received its first rough leveling all in one short-cut operation. This was accomplished as follows: As each truck backed up and the body was lifted to dump its load, the gate swung back and was checked at about 30° opening angle. Then as the truck moved forward and began dumping, a wooden screed, fastened to the hinged tailgate and anchored to the body by swinging chains so that it would not open too wide and lose its raking efficiency, flattened the pouring concrete to a depth of about 12 in.

Concrete was then further spread by a mechanical screed, followed closely by a screed-mounted vibrator.

The whole job was done with a minimum of disruption of normal activity in two operations and personnel buildings within the paving area, where 25 employees plus pilots came and went. Concrete was placed in alternate lanes up to and part way around the buildings, after which the contractor returned to the starting point and completed this part of the apron to reduce interference with airfield personnel.

Transmission Tower Left Undisturbed Across Deep Borrow Area

How to keep from disturbing a high tension line across an extensive hillside which had to be cut down some twenty feet for borrow material, was solved by Northwest Const. Co., Seattle. They simply worked the scrapers around the poles, leaving them on a pillar of earth temporarily until the line could be relocated. The \$182,000 grading job involved was for a 40-ft. fill approaching an overhead on the Seattle-Renton cut-off road, rushed in 1944 to give access to Boeing's B-29 plant, Seattle. Nearly all the 110,000 cu. yd. earth excavation came out of the area shown in the accompanying photo.

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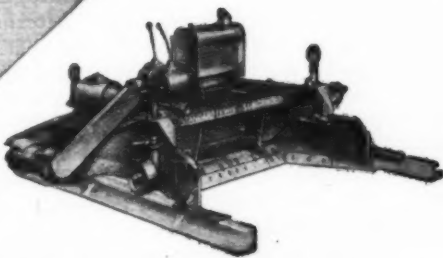
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Asphalt Subsealing of Pumping Joints

By S. O. LINZELL

EDITOR'S NOTE: *The author speaks with experience gained on this subject as an engineer until recently with the Bureau of Maintenance, Ohio Division of Highways. For an earlier less detailed article on asphalt subsealing practice in Ohio, see ROADS AND STREETS, May, 1943, "Pumping Joints Sealed by 'Mud-jacking' Asphaltic Cement," by H. D. Metcalf.*

IT WAS only recently, accelerated by excessive heavy wartime traffic loads, that the problem of pumping concrete pavements became acute in Ohio. In 1942 the situation was brought forcibly to the attention of the Bureau of Maintenance when an epidemic of pumping broke out over the state. It was felt that if an effective seal could be found which would prevent water from seeping through the cracks and joints in the pavement to the subgrade, the problem would be solved. One solution proposed was to seal joints from underneath as well as from the surface. It was seen that since pumping signified an appreciable deflection at the joint under a load, therefore, not only would a seal be needed but also an effective bearing for the slab. Hence the conclusion that material placed under the pavement must not only be waterproof but also provide a good bearing. A reasonably hard asphalt seemed to be the answer.

Various methods and materials were tested and after three years of experimenting, it is felt that a means

of subsealing has been found which is simple and practical. The results have been very successful to date and it is possible a definite remedy has been found for pumping cracks and joints. However, more work and experimentation are needed and the process described in this article will doubtless be improved upon. In order to spare other highway departments the trouble and expense of trying the methods that did not prove successful, a brief description of methods tried is here given.

Several Methods Tried

First tried was the use of asphalt powder mixed with a fluxing oil, injected under pressure through a hole drilled 6 or 8 in. away from the pumping crack or joint. The theory was that a mixture of these materials could be pumped under the pavement and when fluxing occurred a reasonably hard asphalt would be produced. It was soon demonstrated that the amount of powder necessary to produce what amounted to an 85-100 penetration asphalt, made a sticky, doughy mass which could not be handled without heating. Therefore, a heater tank was made and an asphalt pump hooked up. The powder and flux oil were mixed mechanically and heated in the tank and the mixture forced under the pavement. But practically all fluxing action took place in the tank. In effect a 100 pen. asphalt was being made by a round-about method.

A natural conclusion was then to try some of the standard paving

asphalts. Hot 85-100 pen. available at a nearby refinery proved easy to handle and inject. However, after a few very hot days the 85-100 asphalt proved too soft, extruding badly from some cracks and joints. Next 50-60 paving asphalt was tried. This also extruded from some of the more open joints during prolonged hot weather. These materials were pumped at a temperature of 275° F.

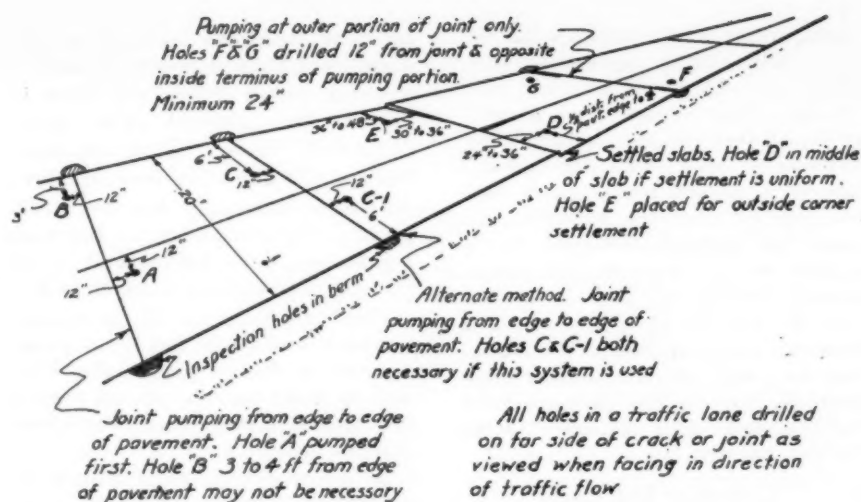
High-Melting Material Tried

Then a really hard asphalt was tried—a locally available oxidized industrial asphalt with 18 to 25 pen. at 77° F. and a softening point of 185° plus. It was seen by this time that for hot weather conditions, an asphalt with a high melting point, yet not too low a penetration range, was needed. This material had the high melting point but seemed to have too low a penetration at 77° F. but was the best material then available. Nevertheless a considerable quantity was used and was generally successful. On one job, after the following winter, about 12 per cent of the joints treated started to pump again, apparently bearing out fears that this material became too brittle during extremely cold weather. This was discouraging when of all the previous materials tried, the paving asphalts and the oil asphalt powder combination, had generally shown from 98 per cent to 100 per cent successes except for the objectionable extrusion that sometimes occurred. It was therefore concluded that the trend to hard asphalt had gone too far, and the decision was to get an intermediate product. For the last two years the material used has been an oxidized asphalt having a softening point in excess of 165° F. and a pen. range of 30 to 45 at 77° F. This material seems to be the answer. It is used alone without any admixture of soil or other materials and is pumped under the pavement at 350° to 400° F.

It would seem that a hot asphalt pumped under a slab would chill and congeal rapidly, thus limiting the distance of under-pavement flow. It was predicted that the hard asphalts would flow only two or three feet from the hole and "freeze." However, in numbers of instances the hot asphalt flowed for surprising distances; in many places, 25 to 30 ft. In one instance hot asphalt (and 18-25 pen. at that) flowed 40 ft. and broke out at the edge of a fill about three feet

Closeup showing inspection hole at edge of pavement just as asphalt is extruding from under slab





Location of Holes for Asphalt Sub-sealing

Asphalt sub-sealing operation

below grade. This ability of asphalt to retain its heat and remain liquid exceeded expectations. Tars were also tried, but at the time the experimental work was done, only road tars were available. These had the disadvantage of too much temperature susceptibility and resulted in the same objectionable extrusion that occurred with soft paving asphalts.

Equipment Developed from Experience

While this materials research was going on, equipment requirements were also being worked out. The equipment first used was a homemade device consisting of a heater tank to which was connected an asphalt pump, rigged so that the pump could be reversed. A flexible metal hose connected to the pump was equipped with a tapered nozzle device which could be driven snug in the holes previously drilled in the pavement slab. The heated asphalt was pumped under the slab until it extruded at the pavement edge. When sufficient asphalt had been forced under the pavement the tapered nozzle was removed and the hole permanently plugged with a soft wood plug. The experimental equipment carried a pressure gauge. Pressures needed were not excessive, 20 to 60 psi. proving sufficient in most instances, a range permitting the use of standard bituminous pressure distributors and obviating special high pressure equipment. All Ohio work since the first year's experiments has been done with regular distributors. There is only one feature that some of the older distributors did not have that is extremely desirable. That is the so-called automatic suck-back that stops drip and is standard on all later type distributors. Either this or a reversible asphalt pump is a valuable safety feature for subsealing with bituminous materials.

Holes Blown Out

During the first experimental year (1942) it was noted that nearly all of the pumping joints had much mud and water under the joints, and that removal would be desirable. A standard part of the operation was to force compressed air under the slab through the drilled hole and thus blow out as much mud and water as possible. The amount blown out was surprising. To keep this from immediately flowing back, holes were dug in the berm immediately adjacent to the crack or joint. These holes, dug an inch or so lower than the under side of the pavement, acted as a sump. The hole also permitted inspection to observe when asphalt had reached the pavement edge, and whether and how much the slab was raised, if raising was desired.

Blowing out of drilled holes soon proved to have other advantages. It cleared any barriers existing to prevent flow of asphalt, including spalls at the bottom of the slab where the drilled hole broke through, and made it possible to force asphalt with much lower pressures.

Another advantage of the compressed air also proved an advantage in raising a sunken slab. Many such slabs adhere to the sub-grade and are hard to start, requiring high asphalt pressures. Blowing with compressed air loosened the slab, helping to start the raise.

Present Methods Used for Subseal or Leveling

Material: An oxidized asphalt having a softening point in excess of 150° F. and 30 to 45 pen. at 77° F. is specified. A tar having approximately the same physical properties may be available. The asphaltic material

that meets these requirements is "AASHO Oil Asphalt Filler Grade A Designation: M 18-42."

Equipment: A bituminous pressure distributor equipped with automatic suck-back or reversible pump and a flexible metal patching hose (1½ in. size desirable) to which is attached a tapered nozzle that can be fitted snugly into the holes drilled in the pavement. Air compressor with two air hoses, one for drilling and one for blowing. Jack hammers and drills to drill holes in pavement.

Holes from 1½ to 2½ in. in size have been used. The smaller is less conspicuous.

Turned soft wood plugs 3 in. long and ½ in. larger diam. than the hole. A slight taper on one end extending up for about ½ to 1 in. helps to start the plugs. A plug is needed for each hole drilled.

Labor: Two men on drilling. Three or four men to handle distributor and asphalt pumping. Heater men at tank car if tank car shipments are used. Two or three heater men required, depending whether 8 or 12-hr. shifts. Heat must be maintained on tank car 24 hours a day, or material obtained hot at a refinery.

Sequence of Operations

A foreman inspects pavement at a favorable time, generally about 24 hours after a rain, and marks joints to be treated. If slab raising is the principal object, this may be done at any time. Immediately prior to drilling, a competent man should mark actual locations of drill holes, location depending somewhat on judgment.

Where a subseal is primarily the object, holes are drilled 12 in. from the transverse crack or joint, on the far side when facing in the direction of traffic. These holes may be as close as 12 in. to the center joint, or in center of traffic lane. If holes are near center joint, one may be sufficient; if however, the hole is in the center of the traffic lane, another hole must be drilled on the other lane in the case of a 2-lane pavement.

When slab raising is primarily the object, the hole is drilled 24 to 36 in. from the transverse joint or crack, and generally in middle of traffic lane.

Each pavement presents its own problems. Experience is soon developed as to the best drilling pattern for the particular pavement. It is not wise to drill too many holes ahead of the pumping operation. The first few joints treated may demonstrate the

advisability of changing the location of the holes, and if several open holes get filled with rain water the subgrade might be softened excessively.

After the holes are drilled compressed air is blown in. A tapered nozzle similar to the one used for the asphalt is attached to the air hose, driven snug, and air pressure turned on for 15 to 60 seconds. If an excessive amount of water and mud is found to be blown out from under the slab into the inspection hole, bale it out or dig a bigger hole to act as a sump.

On the other hand, it may develop that most of the air, mud and water escapes through the joint crack or center joint. Then it may be advisable to seal the crack or joint in the conventional manner from the surface before subsealing starts. The same asphalt that is to be pumped may be used.

Pump Asphalt at 350-400°

The next step is to pump the asphalt under the pavement at distributor temperature of 350° to 400° F. using a patching hose connected to the distributor, and tapered nozzle. The nozzle should be held in the open manhole at the top of the distributor tank and asphalt pumped through it, to see that the hose is clear and to get it warmed up so that the material will not congeal in the hose. The tapered nozzle then is inserted in the hole and driven snug with a 2 or 3-lb. hammer. Asphalt is pumped until it extrudes at slab edges, or until desired raising is accomplished. The nozzle is left in the hole for 30 to 60 seconds after pumping is stopped, then removed and a soft wood plug driven in the hole, completing the operation.

In order to keep from smearing the slab with asphalt leaking around the

nozzle, water is sprinkled around the hole. The chilled asphalt is then easily scraped off the pavement. Should asphalt extrude from a crack or joint before the joint is completely undersealed, or before the desired raising is accomplished, water may be sprinkled over the extruding asphalt the pumping stopped for a minute or so then started again. Usually chilling the asphalt is sufficient to stop the leak; however, if it persists, a pat of moist clay or soil may be placed over the leaking place and held down by foot pressure for a few seconds. This generally stops further leakage.

Quantities and Costs

The quantity of asphalt required is difficult to estimate closely. If undersealing of cracks and joints is the sole purpose it generally requires from 20 to 40 gal. per joint or crack with exceptionally bad pumping joints requiring occasionally as much as 100 gal. If slab raising is the object, several hundred gallons may be required at one location, depending on amount of raising.

With asphalt obtainable at 7½¢ per gal. at the refinery, and hauls of 20 miles or less, the cost of subsealing has been \$5 to \$10 per joint or crack treated, depending on the amount of asphalt used. The above cost is based on common labor at 65 cents per hour. A well organized gang supplied with asphalt as fast as it may be used can treat 80 to 100 joints per 8-hour day.

Handling Material from Tank Cars

Asphalt delivered to a siding in insulated tank cars should be heated to 275° F. or 285° F., before transferring it to a distributor. It may then be heated up to 350° or 400° F., in the distributor in 20 to 30 min. The

car valve, unloading hose and asphalt pump should be warmed up with a kerosene burner before the valve is opened. The material chills easily and readily "freezes up" in cold lines. Heating the unloading hose by blowing steam through it does not work, because the condensate in the hose revaporizes when hot asphalt is let into the line, causing a vapor lock.

Heating a tank car of the asphalt requires from 80 to 100 lb. of steam pressure in the car heater coils. Usually 18 to 24 hours of steam heating is sufficient to raise temperature from 225° F. to 285° F.

A word of caution: A distributor containing any moisture will cause bad foaming as soon as the asphalt comes in contact with the moisture. This often happens if the distributor has been previously used for asphalt emulsion.

Safety Considerations

Handling hot materials always presents the possibility of men being badly burned. Men should always wear gloves and the two men working at the asphalt nozzle must wear goggles. Careful inspection of all pipe fittings and connections must be made frequently, usually with each new distributor load. If unusually high pumping pressures are required (up to 125 psi may possibly occur) the men working with the nozzle could be protected with welders' hoods equipped with clear glass eye pieces.

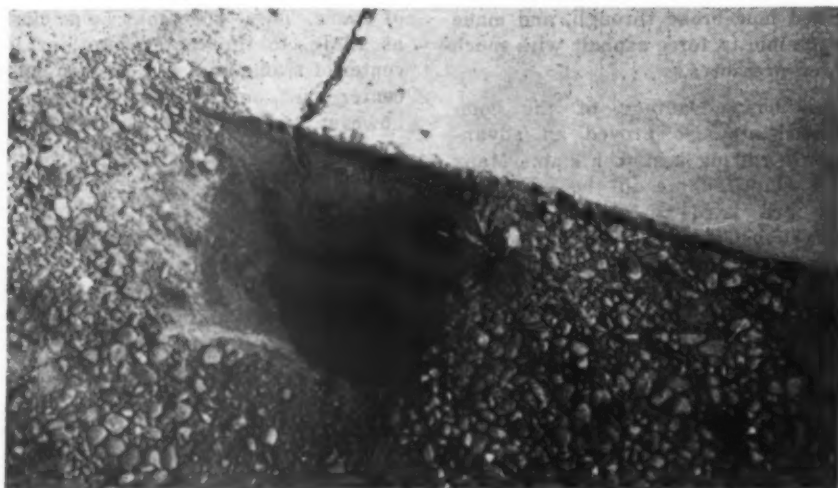
Service Record

Approximately 5,000 joints or cracks in concrete pavements have been treated in Ohio in the last three years. Ninety-seven per cent of the joints treated show no further evidence of pumping, at this writing. Actual measurements of the reduction of deflection of slabs under traffic impact have not been made; however, marked reduction of deflection is evident to the eye in the more extreme cases.

Some Conclusions

The process described is by no means in its ultimate state of development. Mixtures of asphalt with fine filler materials, or other formulas, may be developed as more economical. Low-temperature ductility would be an extremely desirable feature. Proper location of holes with respect to cracks or joints is a phase that needs more study. Slab raising with asphalt appears more costly than by the more conventional mud jacking. However, done in conjunction with subsealing, it may be the practical method, at least

(Continued on page 94)



Showing asphalt nozzle immediately after removal and wood plug being inserted. Note convenient lifting handle on hose line

Moment Charts Aid Design of 3-Span Continuous Bridges

IN order to expedite bridge design work in the face of a shortage of designers, a series of moment charts has been prepared for bridges having three continuous spans of variable moment of inertia.

The function of these charts is to provide moment coefficients for continuous spans with variable moment of inertia for any loading condition. These coefficients are then used in such formulas as $M = \Delta Pl$, in which M is the Moment; Δ is the coefficient taken from the chart; P is the magnitude of the load and l is the length of span. With such a tabulation of information and data a three-span continuous girder with variable moment of inertia may be calculated as quickly as a simple prismatic beam.

Three-Span Continuous Structure Gaining Favor

It is realized that the standardization of bridges is not entirely feasible, but where bridges of one type may serve several locations there is an advantage in having moment charts of this type to assist in the design.

Because of its economy and adaptability to various lengths, the three-span continuous bridge is finding widespread favor. In many cases of three-span bridges, unsymmetrical span lengths are chosen without much thought of economy while often a pier could be shifted a little either way without affecting the water-way or substructure and provide thereby symmetrical spans which may be treated by simplified procedures.

With many sites thus lending themselves to the use of three span symmetrical bridges it was concluded moment charts would serve efficiently in their design, and if designers could thereby be relieved of some of the work involved in routine calculations, more time could be devoted to a more thorough analysis of the larger and more complicated structures.

A considerable amount of flexibility in design is obtained by constructing all charts on a proportional basis. For example; the total length of the bridge, c to c bearings, equals one (1); the end spans have a length of three tenths (0.3); and the center span has a length of four tenths (0.4). The length of the haunch when variable moment of inertia is used is taken as 0.15, 0.25, or 0.50 of the length of the span. The moments

By **PAUL W. MASTERS**

Chief Bridge Engineer, Utah State Road Commission, Salt Lake City

of inertia are on the basis of a ratio of the minimum to the maximum. These conditions are all shown in the accompanying reproductions.

Example of Chart Use

In order to illustrate the use of the charts the following example will be given:

Q. What moment is produced at the left pier by placing a concentrated load, P , of 30,000 lbs in the center span 28.8 ft. from the left pier?
 $k = 28.8/72 = .4$

The characteristics of the bridge are as follows:

No. of Spans: 3, Continuous
 Total length of bridge C to C bearings (L) = 180 ft.

Length of end spans $1_e = 54$ ft.

Length of center span $1_c = 72$ ft.

Length of haunch = 18 Feet or $a' = .25$

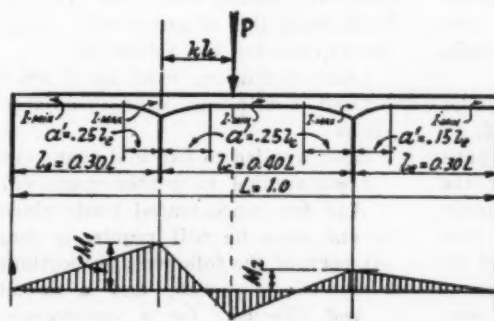
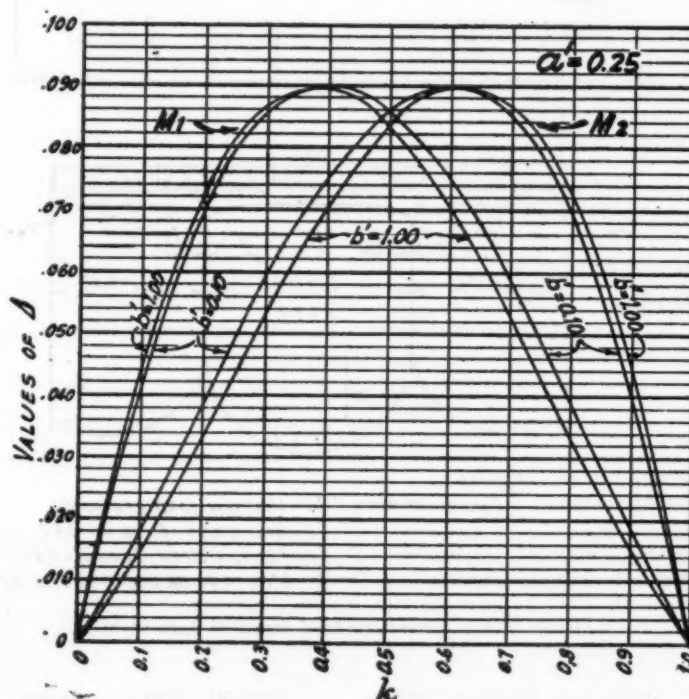
Ratio Minimum to Maximum of inertia $b' = 0.5$

Proceed from $k = .4$, vertically to the M_1 Curve where $b' = .5$ and on the left margin find the value of Δ equals .090. Use this value in the formula $M_1 = \Delta Pl$, thus:

$$M_1 = .090 \times 30,000 \times 72 = 194,400$$

MOMENTS IN CONTINUOUS BEAMS OF THREE SPANS WITH VARIABLE MOMENT OF INERTIA AND PARABOLIC HAUNCHES

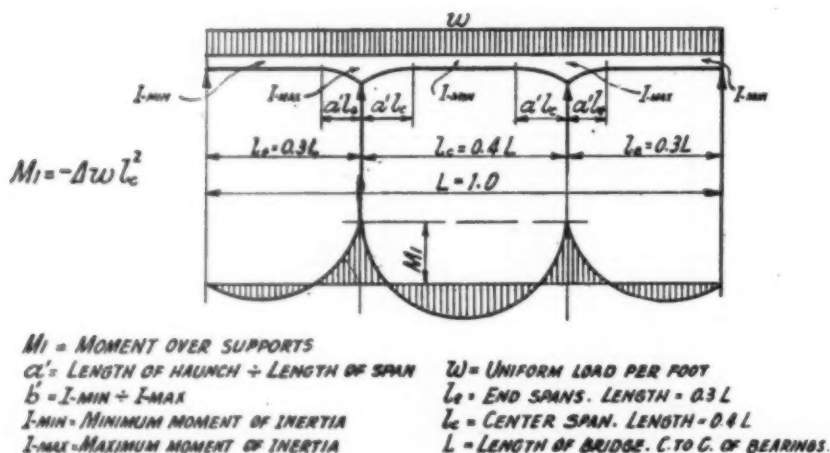
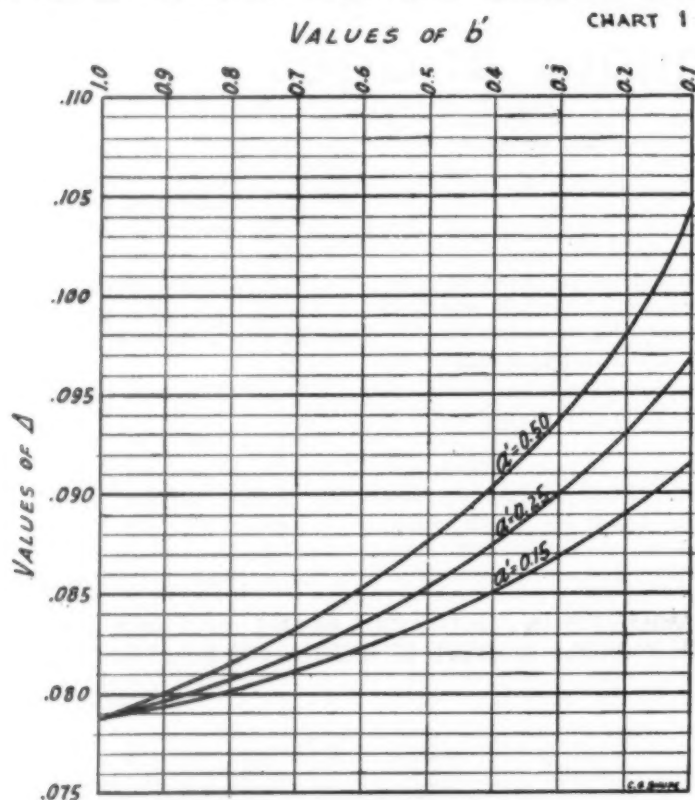
CHART 9



Moment chart for single concentrated load in center span

$M_1 = -\Delta Pl_c$
 $M_2 = -\Delta Pl_c$
 M_1 & M_2 = MOMENTS OVER SUPPORTS
 a' = LENGTH OF HAUNCH + LENGTH OF SPAN
 $b' = I_{\text{MIN}} / I_{\text{MAX}}$
 I_{MIN} = MINIMUM MOMENT OF INERTIA
 I_{MAX} = MAXIMUM MOMENT OF INERTIA
 P = CONCENTRATED LOAD
 k = PROPORTIONAL DISTANCE TO LOAD FROM LEFT SUPPORT
 l_e = END SPANS. LENGTH = 0.3L
 l_c = CENTER SPAN. LENGTH = 0.4L
 L = LENGTH OF BRIDGE. C. TO C. OF BEARINGS.

MOMENTS IN CONTINUOUS BEAMS OF THREE SPANS WITH VARIABLE MOMENT OF INERTIA AND PARABOLIC HAUNCHES



Moment chart for uniform load across all three spans

ft.-lb. It takes about the same amount of time to determine the above moment for the indeterminate structure listed as it does to solve the well known simple beam moment formula $M = PL/4$.

A three-span continuous bridge of the proportions shown, viz., 0.3 of the total length for the end spans and 0.4 of the total length for the center span, provides very closely balanced positive moments in the three spans. This balancing has its advantage in allowing the use of beams having equal depth at the center for each span.

Several charts, similar to those shown, will be required to show all necessary loading conditions. For uniform loads the designer will require charts covering the following:

Load continuous over all 3 spans
 Load continuous over 2 adjacent spans

Load applied to two end spans only
 Load applied to center spans only

And for concentrated loads placed in end span he will require a chart for each of the following proportions: $a' = 0.15$, $a' = 0.25$, and $a' = 0.50$.

And likewise, for a concentrated load placed in the center span he will

require one for $a' = 0.15$, $a' = 0.25$, and $a' = 0.50$, making a total of 10 in all.

The methods and charts discussed here were designed and prepared by Mr. C. G. Shupe, a designer in the Utah state road commission bridge department.

Maintenance of Unpaved Airport Areas

Unpaved areas should be maintained at airports, to provide areas suitable for occasional use, to protect paved areas from erosion, and to eliminate dust hazards. Policing, to remove and then keep out rocks, stakes, stumps, wire, glass, rags, cans and anything which would interfere with landings or mowing, is essential. Fences and guards should keep out livestock. Dust control can be achieved temporarily with an oil dust palliative, but the most satisfactory method is the establishment of a permanent grass cover. Temporary dust control and protection of seedings which will form the permanent cover can be obtained through use of Sudan grass, sorghum, or non-competitive mulch. The perennial cover should be established as soon as possible. Native grass seed can be drilled into both mulched areas and Sudan stubble. Care should be taken to plant species which will survive.

Newly established grass must be carefully maintained, by eliminating weeds, and maintaining a grade of approximately two and one-half inches drop in the first four feet from runways and other paved areas. Flatter grades can be maintained farther from the runway. Erosion must be controlled through adequate drainage facilities and vegetative cover of unpaved areas. Policing of these areas is necessary. Mowing must be suitable for the type of cover, and should not be too low. Fertilizer should be used only when absolutely necessary for health of the grass. Uncontrolled traffic will ruin the best maintenance system. This work should be in charge of one experienced man with complete authority in his sphere.

Maintenance of Unpaved Areas, by D. E. Griffiths, SOUTHERN FLIGHT, December, 1944, p. 58.

The Oregon state highway department has been authorized to undertake a reconnaissance survey for a proposed 50-mile highway between Bates and Baker. At a cost of 2½ to 3 million dollars this road would be of vital importance to lumbering operations and help open up a 7500 mile area rich in mineral resources.

Will Wages Rise After the War?

By HALBERT P. GILLETTE

THE other day an American doughboy in Paris exchanged \$26 for 1300 francs, anticipating a high time on a pocket bulging with paper money, but it bought little more than the 26 "bucks" would have bought at home. Prior to the last World War a franc was worth 20 cts. of our money, and had about ten times its present buying power. Shortly after that war it was worth 5 cts. and now only 2 cts. The cause of these declines in value was primarily an increase in the number of printed francs. We, too, have been increasing our currency, although not on such a scale, and together with a similar increase in bank deposits it has caused wage and price increases.

Recently several writers in business magazines have said that Americans need fear no inflation of wages or prices if they will not lose confidence in their currency, and at the same time do not become foolishly extravagant. Those writers seem to have forgotten that currency inflation during our Civil War and the first World War was accompanied by a great rise in wages and prices; yet no one lost confidence in our currency nor was extravagance abnormal. It is the habit of most Americans to spend almost all they earn in the year that it is earned. That may be extravagance, but, if so, it is not an abnormal factor, and will undoubtedly operate after this war as it has operated heretofore.

In the pre-Christian era of ancient Rome a merchant recorded the fact that when the spoils of war included much gold or silver, it soon went into circulation and raised both wages and prices in proportion to the increase in their money. In modern times we have added paper money and "credit money," which is checking deposits, and the effect of increasing the number of these dollars is proportionately the same as it was in the days of Julius Caesar. This fact tends to be obscured by our banking system and by its reactions on business men who find it difficult either to borrow money or to sell securities during business depressions. In "bad times" vast sums go out of circulation, but eventually, in "good times," they return and have their full effect in raising wages and prices.

Since our per capita currency and checking deposits vary in unison, it will serve present purposes if we consider only per capita currency. To

show how wage rates and per capita currency have risen in unison, let us take carpenters' hourly wages, for they have been typical of average wages of other kinds in America, whether among union or non-union employees. Look at the following little table and read the story for the 80 years beginning in 1860.

Year	Per Capita Currency	Hourly Wage
1860	\$14	\$.20
1919	55	.80
1940	74	1.10
1944	176	?

When we entered the present war the government "stabilized" or "froze" wages to a considerable extent. None the less average factory wages are 50 per cent higher per hour than in 1940, and very much higher per week due to overtime. Based on the economic precedent that wage rates in normal times have been proportional to per capita currency, carpenters' wages would have risen to about \$2.40 an hour in 1944 had they not been "frozen." And other wages, on the average would have become about 2.4 times what they were in 1940.

Word "School" Lettered on Pavement

Oregon's bituminous state roads "speak up" as the motorist approaches a rural school. As shown in photo, the word "School" is kept freshly painted in yellow elongated letters. This warning is placed about 600 ft. from the building, depending, of course, on circumstances. A metal roadside school sign is located opposite.



While the "freezing" of wages has prevented this normal action of an economic law, "freezing" will continue thus to suppress wages only as long as it continues. It is practically certain that scarcely will the war have ended before "frozen" wages will begin to thaw. Only patriotism now restrains insistence by workers that they be permitted to earn all that employers will pay them in the competitive strife to produce goods and services. No political party could long survive the demands of employees that their wages cease being kept in "cold storage," and stamped with a bygone date—1939.

The second chapter of my Handbook of Construction Cost Data relates to wages and prices, and contains data supporting both the wage law above given and the commodity price law. The latter is the wage law divided by per capita efficiency of production. A full statement of both laws involves a factor called the "velocity of circulation of currency" whose relative rate is approximately the ratio of annual bank clearings to bank deposits.

Federal Automotive Taxes—Automotive excise taxes collected by the Federal Government in 1944 show a considerable increase over those for 1943. A comparison of the two years follows:

	1944.	1943.
Trucks	\$10,120,188	\$1,798,380
Automobiles and Motorcycles ...	1,557,800	1,086,456
Parts and Accessories ...	38,775,781	25,063,617
Tires and Tubes ..	54,250,349	31,947,997
Lubricating Oil ..	66,282,554	49,210,861
Gasoline	328,597,298	265,303,272
Use of Motor Vehicles	128,054,437	134,689,279



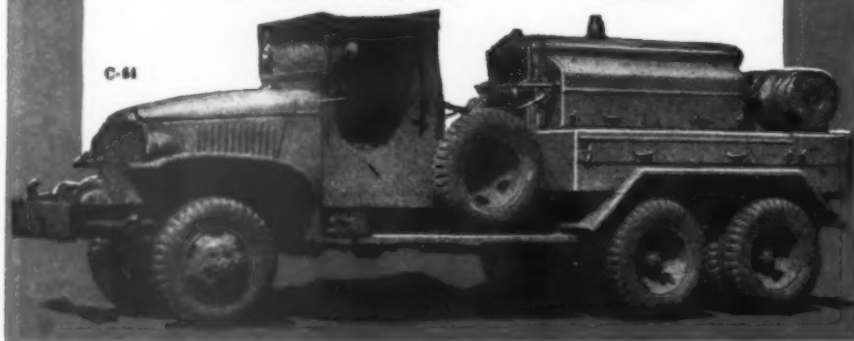
ARMY **E** NAVY

At LeRoi there is a
new **WHITE** star
... our third citation for
meritorious war production

We are happy to display this additional star on our Army-Navy "E" pennant because it is an external symbol of continued excellence in war production and a tribute to our employees for the splendid job they have done. • It is also a reminder — a memorandum to construction men everywhere — that Le Roi Compressors are still going to war and winning laurels on fighting fronts. • However, there is a small percentage of Compressors, Engines and Engine Driven Generators being produced and allocated according to government regulation to those who can qualify as essential users.

Ask your Le Roi distributor for details.

Le Roi Company
1716 South 68th Street
Milwaukee 14, Wisconsin



(Continued from page 76)

also our duty to see that federal money is wisely spent, and there were instances in our recent program of building war airports, where the site selected by the city was inexpensive to buy, but very costly to prepare. In that program, only federal money was used to prepare the landing facilities with the local sponsor providing only the land. If Congress authorizes our proposed program, however, the whole cost probably will be shared 50-50 by the local sponsor and the federal government. Thus, site selection becomes more important financially to both parties.

Superhighway Tolls Opposed

(Editorial, Syracuse, N. Y., "Post-Standard")

New York state car owners are paying enough in the way of taxes; they don't want any toll roads.

This conviction, voiced by Jerome R. Rusterholz of Syracuse as chairman of the New York Highway Users conference, will be echoed by all the state's motorists.

In normal times, before gasoline and tire rationing, the fuel levy brought \$60,000,000 a year into the coffers of the state. The registration and license taxes brought in between \$35,000,000 and \$38,000,000.

Even under rationing, the levies are handsome revenue producers, adding from \$64,000,000 to \$68,000,000 annually to New York's income, with from \$34,000,000 to \$38,000,000 coming from the gasoline levy and around \$30,000,000 from registrations and licenses.

The car owner, by any reasoning, is paying his way and another levy would be unjust.

The income from automobile use in the state will be even higher in the years following the war. If all funds obtained from it were to be devoted to highway construction and maintenance, the ambitious \$840,000,000 program of highway improvement worked out by the state department of public works could be paid from current receipts within 10 years.

The superhighway to be built from Albany to Buffalo, going through Onondaga county near Liverpool, has been proposed as a toll highway similar to the one in Pennsylvania. It would bring business into the state and would repay its cost in this way, at least in part. Tolls are not needed and if they were imposed would be an injustice to the state's car owners, who would be heavy users of the highway.

ASPHALT - AGGREGATE ADHESION AS IMPROVED BY CHEMICAL ADMIXTURE

Case No. 2



• INVALUABLE IN COLD PATCH WORK...

"We have tried the NOSTRIP under rather adverse conditions. One patch was placed in a hole caused by a leaking water pipe under the highway, and although the water is still coming up around the patch after three days the patch itself has remained intact. I believe that it will be invaluable in making patching material in the Winter time where a drying plant is not available and that it could materially reduce costs below that of the conventional central drying plant."

*Above is an excerpt of a letter from a County Maintenance Superintendent to the Maintenance Engineer of a State Highway Department, Names on request.

your first drum



is our best salesman!

THE ALL-YEAR ROAD MATERIAL

NOSTRIP

AN ADMIXTURE FOR TAR AND ASPHALT

MAGUIRE INDUSTRIES, INCORPORATED • NOSTRIP DIVISION • 122 E. 42nd ST. NEW YORK, 17, N.Y.

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Rockford Stabilizing Dirt Streets with Gas House Tar

By T. F. JOHNSON

Asst. City Engineer, Rockford, Ill.

THE City of Rockford has about 250 miles of streets, 80 per cent improved (concrete, bituminous macadam, brick, sheet asphalt). The remaining 50 miles of dirt streets require continual maintenance. For years they have been maintained by blading, filling holes with cinders, and applying road oil during the summer to keep down the dust. They have also been a source of numerous complaints. Many of these streets have never been graded to a true grade line, and therefore the drainage is bad. Then, too, successive application of cinders has raised the grade above the existing sidewalk and adjacent property. Some streets have a fairly hard surface built up from applications of oil and asphalt which would be quite satisfactory if the grades were down where they should be.

For years we have felt the need of a low cost improvement for these so-called dirt streets in order to keep maintenance cost down. It is practically impossible to assess the adjacent property owner for any type of improvement. Since the cost of any improvement must be done with maintenance funds, it was hence necessary that, whatever type of improvement afforded these streets, the original outlay of cost must result in a saving over a period of years to the city.

Our engineering department has laid out a 5-year program of improvement for dirt streets by stabilizing with gas house tar, locally available during the war period. In 1943 we made arrangements to purchase all the coal tar from the local gas plant. This material was not restricted in any way. We pay 5c per gallon.

Soil Tests Dropped; General Procedure Followed

During the early use of this material the City Testing Bureau took soil samples on each street to be treated, to determine the moisture and tar percentage that should be added to give greatest compaction under rolling. However, this practice has been discontinued, since from experience we have found that construction methods used did not warrant the refinement of these tests, and it also caused considerable delay in the operation, as the existing moisture in each street had to be determined prior to construction.

The general procedure of stabilization is as follows:

The street is first excavated or filled to a true line and grade furnished by the engineering department. The street is completely scarified (3 in.). Water is added using a pressure distributor, the amount depending on existing soil moisture determined by visual inspection. The soil is well mixed with a power grader and disc. About 5 gal. per sq. yd. of gas house tar is then spread on the roadway by means of a pressure distributor, and the blading and mixing operation is continued until tar and soil are thoroughly mixed. Another application of .5 gal. is applied and completely mixed as before.

The roadway is then bladed to a proper crown and cross section (crown usually 5 in. for 30-ft. roadway). The roadway is then rolled and compacted and visible stones larger than 2 in. taken out. For seal .2-gal. coat of pea gravel and asphalt is applied.

If there appears to be any soft spots in the roadway after rolling, due to excess moisture, they are dug out and replaced by hand with suitable material. In some instances the sealing is delayed for several days to allow evaporation of excess moisture.

Although we have not had much time to observe the result of the above construction, so far we are quite satisfied, considering the method used and the low cost, and feel that it will lessen our maintenance cost considerably.

In connection with stabilizing streets, we are trying to induce the abutting property owners to pay for the cost of 2-ft. concrete curb and gutter, thereby enhancing the value of the improvement.

We have built 3.65 miles of such concrete curb and gutter in the past year. This work has been done by petition from property owners. Construction is done by an outside contractor after all collections have been made.

In selecting the streets to be improved by stabilization we try to pick the ones that carry the most traffic and on which the maintenance has been high. During the 1944 season, we stabilized 3.3 miles of dirt streets (50,000 sq. yd. at a cost of about 15c per square yard).

\$153,000,000 Road Plan Urged in Massachusetts

A six-year program, \$153,000,000 to modernize Massachusetts highways, has been recommended by the Legislative Recess Commission on Post-War Highways.

The program, according to a news dispatch, would be self-liquidating under the plan, which falls for financing from current highway receipts, mainly gasoline taxes.

Declaring that "maintenance cannot cure obsolescence," the commission said:

"It is obviously unsound to continue year after year heavy annual expense on worn-out highways without permanent improvements."

Of the outlay, \$90,000,000 would be for State highways, \$30,000,000 to fill gaps in cities and towns in the system, \$3,000,000 for the Boston metropolitan district and \$30,000,000 for joint construction with State, county and municipal funds.

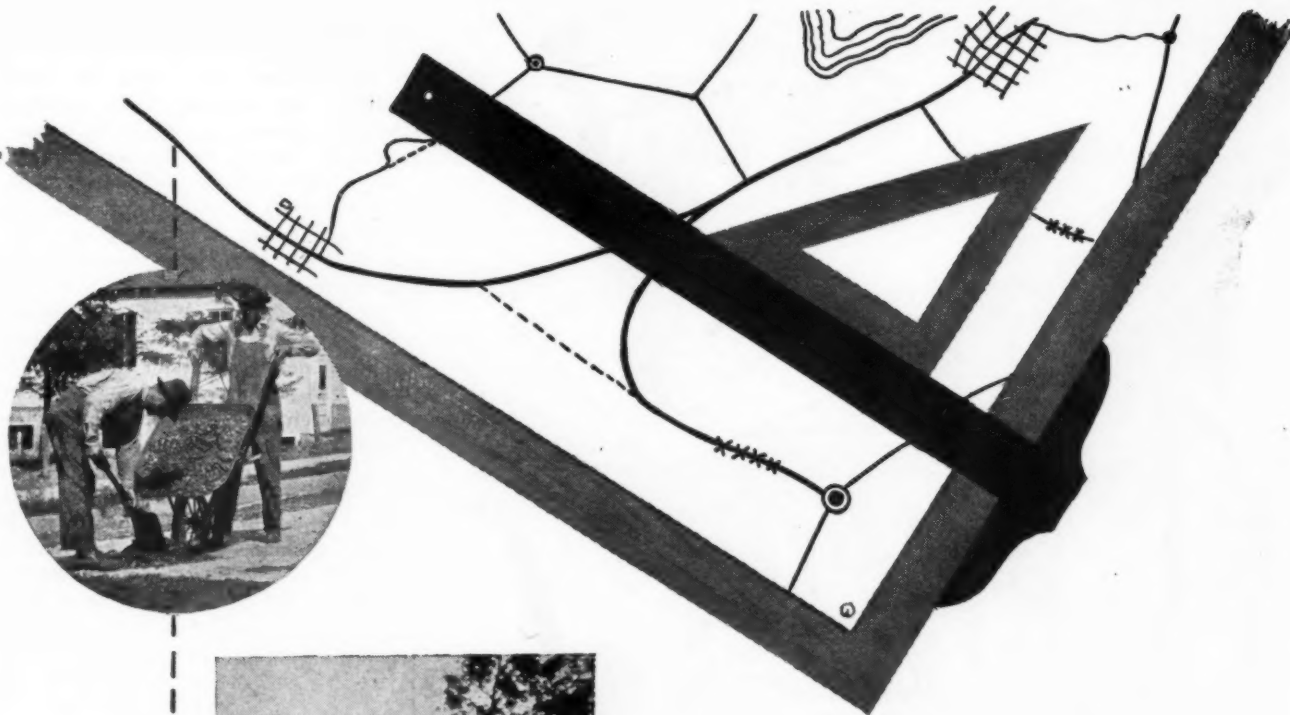
The commission urged reconstruction of at least 70 miles of state highways a year, completion of plans for "a great artery in Boston through a maze of narrow winding city streets," a \$7,500,000 annual state appropriation for six years to match Federal funds for highway improvement and allocation of \$5,000,000 a year to cities and towns in proportion to expenditures for local highway purposes during the last ten pre-war years.

The commission stated that traffic was slowly "strangling" Boston and that "nothing short of a major operation can avoid serious consequences to its future growth and prosperity."

Pointing out that Boston lacked the natural possibilities of New York and Chicago, the commission declared that the traffic condition here "constitutes a problem to traffic engineers perhaps unparalleled anywhere."

It could not be solved, the commission continued, "without interfering with many established institutions, practices and customs; however, to exist socially, commercially and economically, Boston must have modern traffic facilities."

City engineers working with the commission suggested a new north-south central artery from the Charles River dam to Albany Street in South Boston. This artery, utilizing sections of Charles Street, which bisects the Common and the Public Garden, would be an elevated structure, a depressed highway, an expressway at grade or a suitable combination of the three designs.



Spring Maintenance and Postwar Planning go hand in hand

Each spring presents road officials and highway engineers with a new set of maintenance problems.

This year the requirements are particularly acute, (1) because wartime traffic has put an extra heavy burden on America's roads, (2) because for the third straight year regular maintenance programs have been curtailed by manpower and other shortages, and (3) because in most sections of the country the winter has been exceptionally severe. Meeting the situation is today's No. 1 road job, but meanwhile planning for post-war highway development is becoming increasingly important.

Why not talk over your problems with the Tarvia field man? He can show you how you can use Tarvia and Tarvia methods to coordinate your future construction plans with immediate maintenance needs—how you can quickly and economically strengthen and repair the existing roads that will be a part of your all-over building program.



THE BARRETT DIVISION

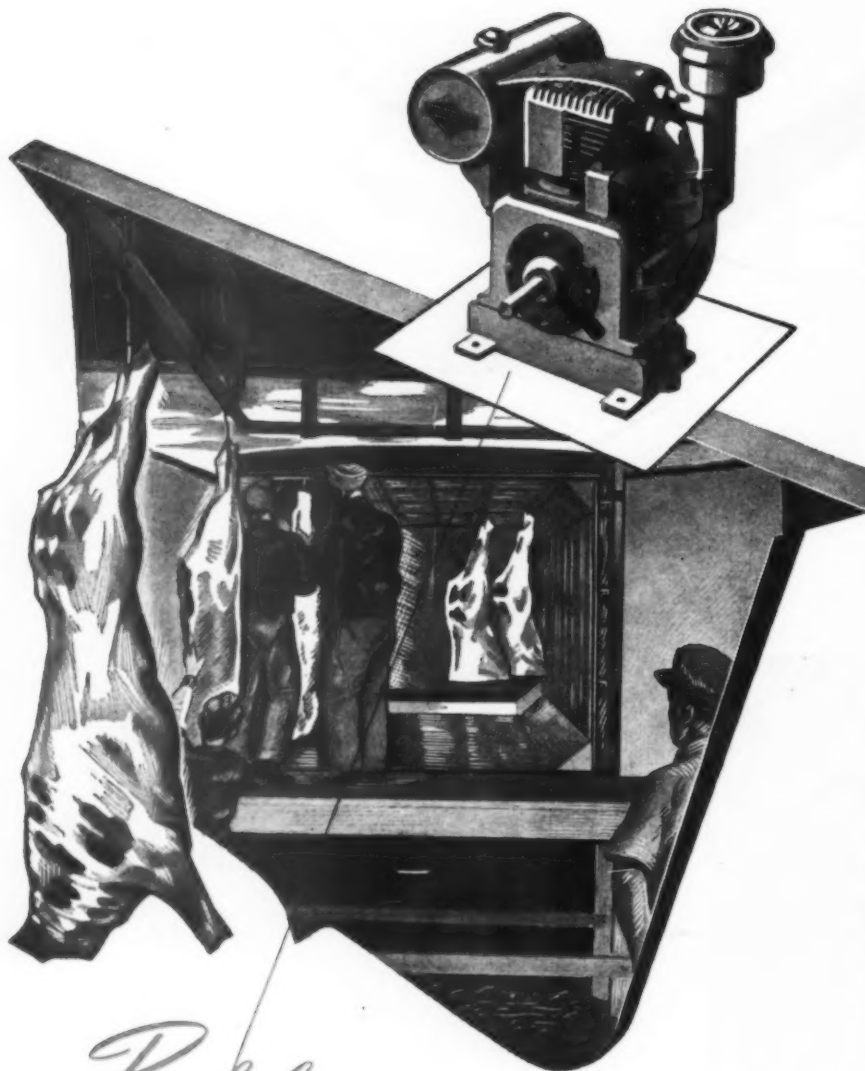
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in cases of minor settlements of 1½ in. or less.

The process also opens up possibilities for sealing leaks through bridge abutments, retaining walls, concrete tunnel or subway linings, mine shaft leakage, foundation leakage or sealing off leakage under or through dams. Some of these applications are being experimented with at the present time.

It is the opinion of many engineers that this method of subsealing represents a definite gain in the effort to solve the pavement pumping problem. Many men in the Ohio Highway Department assisted in its development. The first experimental work was done in Division 5, by a maintenance crew under the supervision of Mr. C. B. Cunningham, Assistant Division Engineer. Special credit should be given to John Goshorn of the State Highway Testing Laboratory for his helpful suggestions and technical advice.

Airport Design References

The Civil Aeronautics Administration has issued a comprehensive pamphlet on airport design. It includes planning, factors influencing size, and selection of the site, investigation of soil conditions, drainage system, grading, turf, pavement, lighting, buildings, master plans for various types of airports, and maintenance. Tables and charts cover an index of aircraft, recommended design standards, airport size planning standards, lighting standards, surface grades and minimum clearances recommended standards for taxiways. The appendix includes a list of publications and materials on airports, and survey material on approach protection. Civil Aeronautics Administration, U. S. Department of Commerce, AIRPORT DESIGN, 1944.

Kaiser Engineers Organized

Engineers long associated with Henry J. Kaiser, and responsible for the design and construction of some of the world's outstanding projects, have been organized as a permanent group known as Kaiser Engineers, with headquarters in the Kaiser Building, Oakland, Calif. Henry J. Kaiser is president of the new organization, with E. E. Trefethen, Jr., Vice President; T. M. Price, Vice President, and George Havas, Vice President and General Manager. The company will undertake engineering work in any part of the world. Mr. George W. Vreeland will serve as chief consulting engineer and George B. Scheerr as chief consulting electrical engineer.



He KNOWS how it HANDLES

Or talk to the owner, too. They will tell you why the **STANDARD STEEL MODEL 424** is the *most profitable distributor* that they have *ever owned*. Here's some of their reasons:—

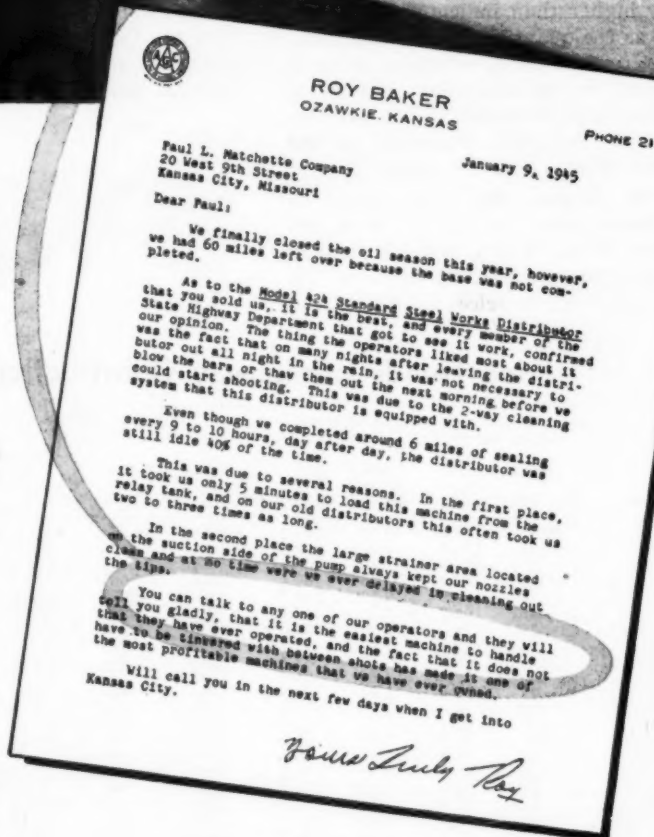
First: the gang was *never delayed* in the morning waiting for the operator to *thaw out* the unit. The **TWO-WAY CLEANING SYSTEM** quickly and easily cleaned out the pump, spraybar and entire piping system "... even though the distributor *stood out* all night in the *rain* it was *ready to go on time* the next morning".

Second: *No time lost loading*—the **MODEL 424 STANDARD STEEL DISTRIBUTOR** was loaded in *less than half* the time taken by other distributors.

Third: The *big four inch 375 GPM pump* kept the unit *way out in front* of the gravel gang "... the distributor was *idle 40% of the time*".

Fourth: *No hold-up* between shots *cleaning out* spray tips "... *large strainer* always *kept nozzles clean*." *No tinkering* causing costly delays "... it was one of the *most profitable machines* we ever owned".

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Price Trends in Highway Construction

HIGHWAY construction costs reached a war peak in the spring of 1943 and since have consistently receded, according to bid price data reported by the Public Roads Administration of the Federal Works Agency. Prices are still 43.1 index points above the 1940 level but even with this increase they are about at the level of 1923.

The Public Roads index of 100 corresponds to the cost of a mile of road composed of units of work representative of 1925-29 construction at the average unit bid prices of that period.

The remarkable advance in the development of road-building machinery and in the efficiency of contractor's operations produced a decline in the cost index from 117.9 in 1923 to 71.6 in 1940. War activity pushed the index up to 131.0 in the spring of 1943 but it receded to 114.7 in the spring of 1944.

Actual costs per mile are considerably higher than indicated by the index as the quantities of the composite mile remain fixed, whereas, gradual raising of standards has greatly increased the quantities in the average mile of highway, according to the Public Roads Administration.

The general downward trend in highway costs per unit of work between World War I and World War II was accomplished in spite of the upward trend of prices in general and

more exacting requirements introduced in the past 25 years are the placing and compacting of fills in thin layers, accurate proportioning of aggregates for concrete, and smoother finishing of road surfaces.

The great advances made in grad-

ing equipment are reflected in the average price per cubic yard for grading. The average price dropped from 47c in 1923 to 18c in 1932, rose to 29c in 1934, dropped to 21c in 1938 and remained constant at that figure until war preparations caused a general upswing in prices. The war peak of 47c per cubic yard has already declined to 38c.

Ice Control on State Highways

The control of slippery condition on highways has become a very important feature of winter maintenance. In fact, in some states, expenditures for ice control are greater than for snow removal. Vermont, for instance,

during past four years, expended \$534,000 for snow removal and \$1,116,000 for ice control. The following table from the recently issued 12th biennial report of the State Highway Board shows the expenditures for winter maintenance for the past four years:

	Snow Removal	Ice Control	Snow Fence	Misc. Work	Total
1940-41.....	\$104,252	\$337,776	\$ 17,997	\$ 49,112	\$509,138
1941-42.....	114,087	297,355	21,043	83,589	516,074
1942-43.....	146,131	222,638	23,142	54,899	446,810
1943-44.....	169,456	258,682	26,051	87,627	541,816

In New Jersey, in the 4-year period, 1940-43, the state highway department expended \$1,178,000 for snow removal and \$1,223,000 for ice con-

trol. The expenditures by years, according to the 1943 report of the state highway department, Spencer Miller, Jr., Commissioner, were as follows:

	Snowfall Inches	Snow Removal	Ice Control	Snow Fence	Combined Operations
1940.....	28	\$303,000	\$283,000	\$ 79,000	\$665,000
1941.....	33	460,000	280,000	95,000	835,000
1942.....	17	161,000	308,000	101,000	570,000
1943.....	18	254,000	352,000	86,000	692,000

Price Trends in Highway Construction

Year.	Common Excavation		Concrete Pavement		STRUCTURES Bid Price				Composite Mile Index
	Bid Price Cu. Yd.	Sub-Index	Bid Price Sq. Yd.	Sub-Index	Reinforcing Steel-lb.	Structural Steel-lb.	Structural Concrete Cu. Yd.	Sub-Index	
1922.....	\$0.40	114.5	\$2.28	102.7	\$0.050	\$0.074	\$20.18	95.1	105.8
1923.....	.47	133.3	2.43	109.5	.057	.078	23.37	108.6	117.9
1924.....	.43	122.2	2.40	108.3	.057	.077	22.91	107.2	113.1
1925.....	.39	110.0	2.36	106.4	.056	.067	22.53	103.9	107.5
1926.....	.36	103.7	2.29	103.1	.053	.074	22.76	103.7	103.4
1927.....	.35	100.3	2.29	103.3	.051	.071	22.65	101.5	101.9
1928.....	.34	96.0	2.10	94.5	.049	.067	21.22	96.1	95.3
1929.....	.32	90.0	2.05	92.7	.048	.059	21.58	95.0	92.1
1930.....	.30	86.3	1.86	84.1	.045	.061	20.08	89.4	85.7
1931.....	.27	77.6	1.68	75.6	.040	.054	18.02	79.9	76.8
1932.....	.18	55.0	1.44	64.8	.034	.046	15.33	68.0	61.0
1933.....	.26	74.0	1.67	75.1	.038	.046	16.15	72.2	76.7
1934.....	.29	83.3	1.90	85.8	.043	.053	17.73	80.8	84.0
1935.....	.26	73.3	1.90	85.6	.044	.052	17.78	81.5	80.6
1936.....	.26	74.8	1.91	86.0	.046	.060	20.25	90.0	82.9
1937.....	.24	69.0	1.89	85.1	.048	.060	19.76	81.5	79.4
1938.....	.21	59.8	1.72	77.5	.045	.063	19.06	87.2	72.8
1939.....	.21	59.8	1.73	77.8	.044	.059	19.13	85.9	72.6
1940.....	.21	59.2	1.68	75.6	.045	.063	19.17	87.6	71.6
1941.....	.24	69.2	1.89	85.2	.054	.076	21.44	100.8	81.8
1942.....	.37	105.5	2.44	109.7	.065	.090	26.16	122.3	109.9
—1943—									
1st.....	.44	124.5	2.90	130.8	.073	.093	30.02	137.6	129.6
2nd.....	.47	134.5	2.83	128.6	.067	.092	30.17	134.3	131.0
3rd.....	.44	123.9	2.70	120.7	.067	.097	29.48	133.1	124.3
4th.....	.42	119.6	2.70	120.7	.059	.096	31.08	132.4	122.7
—1944—									
1st.....	.39	111.1	2.67	120.4	.066	.094	30.35	134.4	119.1
2nd.....	.38	108.3	2.48	111.8	.064	.093	32.62	138.9	114.7
Base									
1925-29....	0.35	100.0	2.22	100.0	0.052	0.067	22.15	100.0	100.0

Notes: During the years 1925-1929 inclusive the average mile involved the movement of 17,491 cu. yd. of earth and similar materials, 3,726 sq. yd. of paving,

16,000 lb. reinforcing steel, 4,325 lb. structural steel, and 68 cu. yd. of structural concrete. These quantities form the base for the composite mile.

(Continued from page 67)

the rental rates set forth in MPR-134. However, the eye strain caused by studying the small type of the printed OPA regulation is overcome by the "Green Book's" use of bold, black type, and an aspirin for price quotation headaches is supplied by a schedule arrangement classifying prices for major equipment in large bold-face type with minor equipment, which would be accessory to the major equipment, set directly below but in a type size and face that makes it easily distinguishable from the major equipment item.

The "Green Book" was prepared by the Rental Committee of the Associated Equipment Distributors. A foreword by Committee Chairman Eldon M. Farnum of St. Louis, on OPA's rental rate investigation leading up to MPR-134 and MPR-136, says:

"The AED has tried to assist OPA in its very thorough examination of rental rates. That office has expressed its appreciation of our efforts. We shall continue to extend any assistance to OPA that may be required of us."

Equipment Maintenance

Track Bolt Tightener Sends Tractors Out Half Day Sooner

A SHOP-BUILT power bolt tightener used by Western Contracting Corp. of Sioux City, enables two men to disassemble and assemble the tracks on a heavy tractor in 5 hours. Performing easily a job that usually takes 3 men two days with lots of grunting, this outfit is a rubber-tired wheelbarrow-like rig which straddles a track laid out on the shop floor. The operator moves the machine along from bolt to bolt, giving them the business via a socket wrench fitted on the bottom of a vertical, clutch-controlled, reversible tightening shaft.

Power is supplied by a 5-h.p. gasoline motor, through a power take-off shaft, a clutch made up mostly of Ford car parts, and a reversing gear made from a Ford differential enclosed in a shop-built housing. Clutch and differential are controlled by hand levers which the operator manipulates after setting the tightening shaft down on a bolt. The second man holds the nut with a hand wrench.

The unit is the brain child of I. L. Gebhart, Western's construction manager, famed as sheepfoot roller designer. In three years it has paid for itself many times over according to

A. A. Ahl, shop superintendent at Wood County Airport, Parkersburg, Va., where your editor saw the machine on the Myers-Western excavating job.

Making a Used Rig Safe

By DICK MITCHELL

Mr. Mitchell has been associated with the Driscoll Construction Company for 22 years, the last 15 years as superintendent of all property and operations. Because of labor shortage and difficulty obtaining needed equipment, the Company has leased most of its machinery. It now specializes in machinery repair and rebuilding work. Heavy duty repair and rebuilding for contractors, factories and the Government keeps a force of machinists, blacksmiths, and welders busy the clock around.

WHEN a contractor brings in a crane, bulldozer, or a paver for a rebuilding job, we do not consider our task completed when the machine passes its final test after assembly. We learned in working on our own equipment during the past twenty years that a rebuilt job needs to be double-checked for safety. Fortunately we have an experienced mechanic who is a safety expert. He has the final say.

His work begins when the machine to be repaired or rebuilt is given its pre-work inspection and the estimate cost on the job is figured. If the equipment needs safety guards, a different type of cable, or more of a rebuilding job than has been ordered, the recommended "safety additions" are included in the estimate and explained to the owner.

All replacement parts are checked for safety. If used wire rope is to be returned to a machine, that rope is carefully inspected and checked. If a



Built like a wheelbarrow, this motor driven track bolt tightener has paid for itself many times over



Safety inspector checks spooling, drum and preformed cable on a power winch built in the Driscoll shop

new cable is to be installed, we always recommend preformed, having found it safer than non-preformed, in our own work on winches, cranes, draglines, shovels, scrapers and bulldozers. We have never had a hand or eye injury from handling this type of rope, or a serious accident from breaking.

How Used Cable Is Re-installed

In preparing used cable for re-use on the rebuilt machine we follow a set procedure. The rope is scrubbed with a cleanser, allowed to dry, inspected and tested; then repaired. Exact findings are noted on a card which is attached to the machine. This information is also given in the job report.

When the rope is put through our

lubrication bath it is again allowed to hang and drain. When put back on the machine it is run through several times in the shop. It is given its final check when the repaired or rebuilt job is taken to our lot for the operation test.

The same emphasis on detail is followed in checking clutches, gears, treads, drums, engine assembly—in fact every part of the job. And this is not done just to “keep busy,” because we have far more work than we can handle, as I think is the case with most repairers and rebuilders today.

Thoroughness Pays

First, we feel that we have a record to hold. So far as we know no re-

building job which we have completed has ever caused a serious accident. Next, we find that the additional check on the *safety factor* is a double-check on the repair or rebuilding work we've done. Safety, longer life and better operation all go hand in hand.

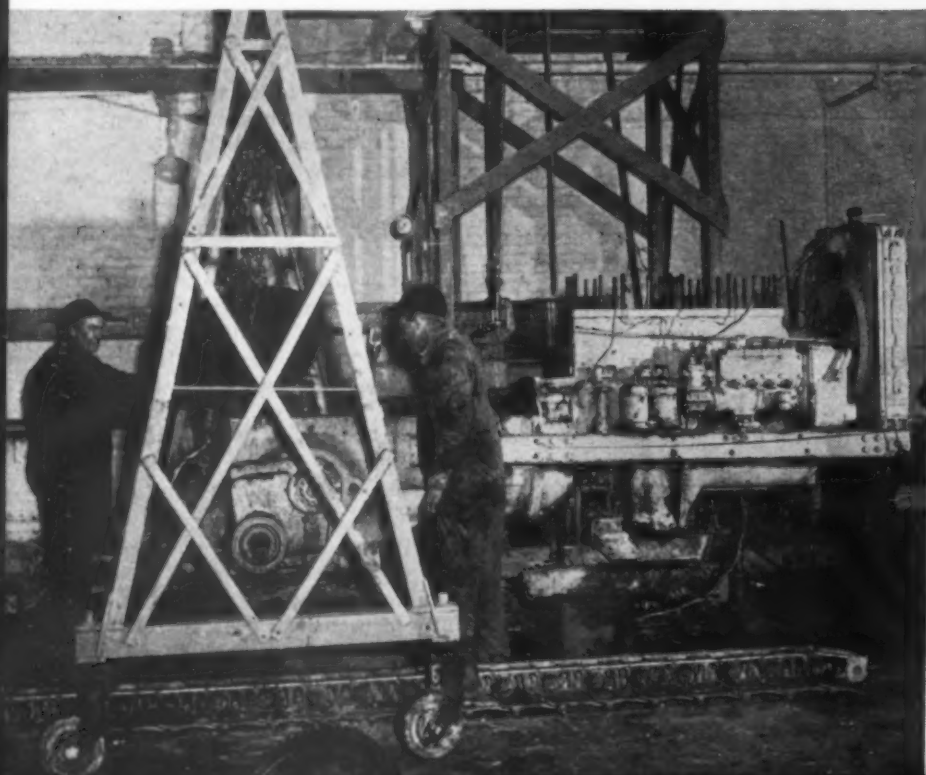
And finally, from years of experience, we have learned that the rebuilt job, often using salvaged parts from similar equipment, needs this extra safety attention. Frequently a piece of equipment has passed inspection in our shop but when taken to the lot for a trial run will show up with “bugs.” These are needed adjustments or repairs not found in the initial inspection,—or, faults in equip-



Hand Punch Helps Start Drill Accurately

This fellow is working a simple but useful trick. The objects he is punching are angle irons, needed for snow plow repair. As a preliminary to drilling bolt holes he is punching slight indentations as precisely spotted chalk marks, which will help start the drill press bit accurately in the absence of a modern adjustable holding clamp on the press. Photo snapped in a country garage by your ROADS AND STREETS editor during the recent snow storms.

Well designed portable hoist frame in the Driscoll shop—tractor bearings have been removed and mechanics are working on the final drives



ment on building

Paying always n tion wor is payin cost per fact tha safety c building tion fau

All h are face what th another building erably l will dou But ther if prop safety.

Super- W

A far messy g tional s is the the Ion garage. area is As a m the fron of a sp cleanline conspicu

The fl greasing eral tim evening floor is day the neat rec Then ev with a third wa

Count believes in seven of the encoura their to taking waged o repair sh swept pl

And o employe Each m every ot with a worn in in summ worker

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ment or parts which we used in rebuilding.

Paying special attention to safety always pays big dividends in construction work. It used to pay us and it is paying our customers. The added cost per job is small. We know for a fact that in many cases adding extra safety equipment at the time of rebuilding has corrected former operation faults and accident hazards.

All heavy duty machine operators are faced with the problem of making what they now have last for at least another year. Their repair and rebuilding cost for 1945 will be considerably higher than in 1944. There will doubtless be more costly lay-ups. But there need be no more accidents if proper emphasis is placed on safety.

Super-clean Grease Rack Has White Sawdusted Floor

A far cry from the old fashioned, messy greasing corner with its traditional slippery, oily, mud-caked floor, is the spic-and-span grease rack at the Ionia County (Mich.) highway garage. As pictured, this grease rack area is kept almost "hospital clean." As a matter of fact, being up near the front entrance, it is the show place of a spacious, modern garage where cleanliness and good housekeeping are conspicuous.

The floor area and walls around the greasing hoist are painted white several times a year, as needed. Each evening at the close of the day the floor is cleaned, and several times a day the sawdust is swept up into a neat rectangle covering the drip area. Then every Friday the floor is mopped with a grease solvent to which one-third water is added.

County Engineer Allan Williams believes this extreme cleanliness pays in several ways. It keeps grime out of the oiling and greasing process, encourages the service men to be on their toes and do an efficient, painstaking job. It is part of the war waged continually against dirt in the repair shop area, which is also a clean-swept place.

And cleanliness helps the garage employees feel proud of their jobs. Each man is issued clean uniforms every other day, as part of a contract with a local laundry. Coveralls are worn in winter and shirt and pants in summer, and a dirty, untidy looking worker feels out of place in this shop.

All of which is of considerable value too, in making visitors feel that the highway garage is an efficiently operated public service.



This white-painted floor is swept daily, mopped weekly with grease solvent, kept covered with sawdust

Steel Shipping Frame Protects Spare Truck Motors

Even the sturdiest wooden shipping crate sometimes gets sprung or comes apart in unloading and handling engines. Why not fit spare engines into a strong, light welded steel cage—one that gives the engine a sturdy rigid bed, acts as a frame to which wood or plywood sheathing can be fastened, and includes convenient lifting stirrups?

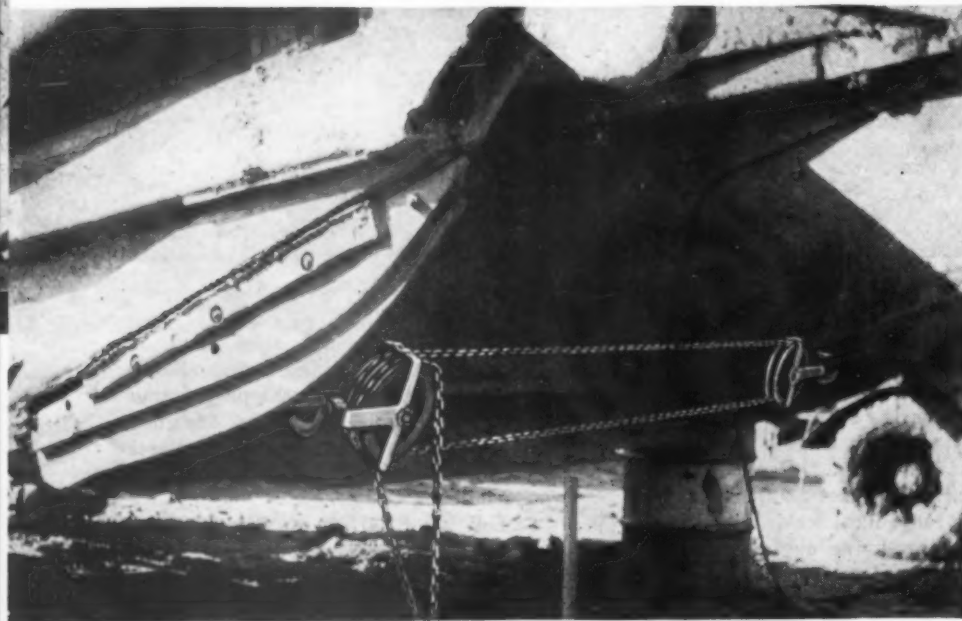
So reasoning, the shop men of Western Contracting Corp., Sioux City, built the handy shipping frame pictured. It is one of several designed specially for spare Cummings diesel engines used in the firm's fleet of Euclid rock trucks.

The upper half of the frame can be unbolted and removed when desired. Lag screw holes are provided for fastening on sheathing. The motor is bolted securely to its bed using iron straps at either end.

Handy iron crate frame devised by Western Contracting Corp. shop crew



How Sprung Scraper Blade Was Repaired in the Field



THE accompanying photos show how one vertical cutting edge (bowl edge, "landside," or whatever you call it) of a 33-yd. La Plante Choate Model C-104 scraper was pulled back into shape after a mishap on Myers-Western's Wood County airport job, Parkersburg, W. Va. The right edge had been sprung outward by a boulder while on fast night work.

The procedure in making field repairs was as follows:

(1) The sprung edge plates were cut away by applying the torch along the factory weld lines.

(2) The plates were rewelded in a partially straightened position, leaving the heavy outer stiffener plate temporarily unwelded in order to make it easier to effect final straightening.

(3) Lugs were then tackwelded against the inner side of both side plates, and a 3-part chain hooked across as a means of applying an inward pull to further straighten the sprung side.

(4) The sprung plates were heated with the torch to a temperature approaching dull red heat, and at the same time the chain was cautiously tightened, slowly pulling the plate to correct position.

(5) During and after cooling, the joint of the outer stiffener plate was rewelded, the chain released and the lugs burned away.

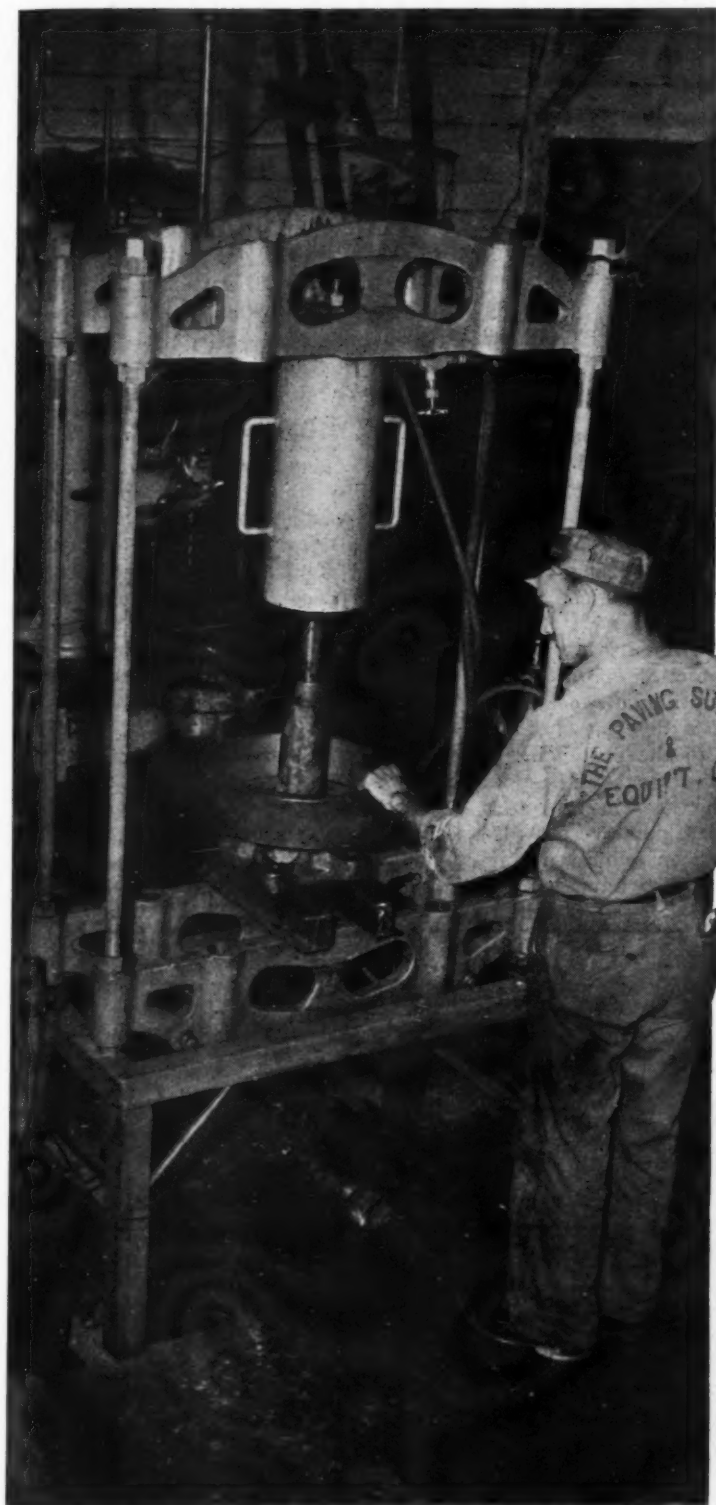
Outstanding State Obligations for Highways Total \$1,618,049,000

State highway obligations outstanding Dec. 31, 1943, totaled \$1,618,049,000, according to figures recently released by the Public Roads Administration. The purposes for which these obligations were incurred include:

State highways	\$ 975,213,000
Special state issues for bridges and grade crossings	152,090,000
Special construction issues, state highway share	42,970,000
State issues for toll roads and bridges	156,247,000
State issues for reimbursement	98,425,000
Reimbursement obligations assumed	182,512,000
State issues for county or local roads and bridges	10,592,000
	\$1,618,049,000

Against the above obligations there was held in sinking fund reserves on December 31, 1943, the sum of \$208,903,437.

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Watch Wheel Bearing Lubrication

IN recent months attention has been focused on the proper servicing of wheel bearings by a controversy over the practice of filling hubs full of grease. Many truck manufacturers have taken the stand that this practice is not in line with most efficient service.

The following helpful pointers are passed along to "Roads and Streets" readers with permission of Gulf Oil Corporation, Pittsburgh.

Completely filling wheel hubs with grease may theoretically provide grease for extended servicing periods. However, it must be remembered that when grease is heated it expands in volume. The temperature of wheel bearing grease may be raised due to internal friction in the grease itself, due to working in the bearing or from heat transmitted from the brake drums.

If the hub is completely filled, sufficient pressure may be built up, due to expansion on heating, to damage the grease seals and allow the grease to run out onto the brake drums. This may necessitate relining of brakes.

Pack by Hand or With Packer

A better recommendation for servicing wheel bearings is to pack the bearing either by hand or with a wheel bearing packer. If desired, a small amount of grease can be placed in the hub, however, under no circumstances, should the hub be completely filled. It is usually necessary to remove front wheel bearings for servicing, although some manufacturers provide plugs which can be removed for the insertion of pressure fittings. In some equipment rear wheel bearings are lubricated from the rear axle. In other designs it is necessary to remove the rear wheels to lubricate the bearings. The third method of lubricating the rear wheel bearings is by means of pressure fittings.

Proper interval for wheel bearing lubrication varies somewhat with design of equipment and type of service. It is recommended that wheel bearings be lubricated at 5,000 mile intervals, or twice yearly. Manufacturers' recommendations for wheel bearing lubrication vary from 5,000 to 15,000 miles, again depending upon design. Adherence to the shorter mileage interval will serve the dual purpose of assuring proper lubrication and, at the same time, providing for more frequent inspection of the bearings.

How Often?

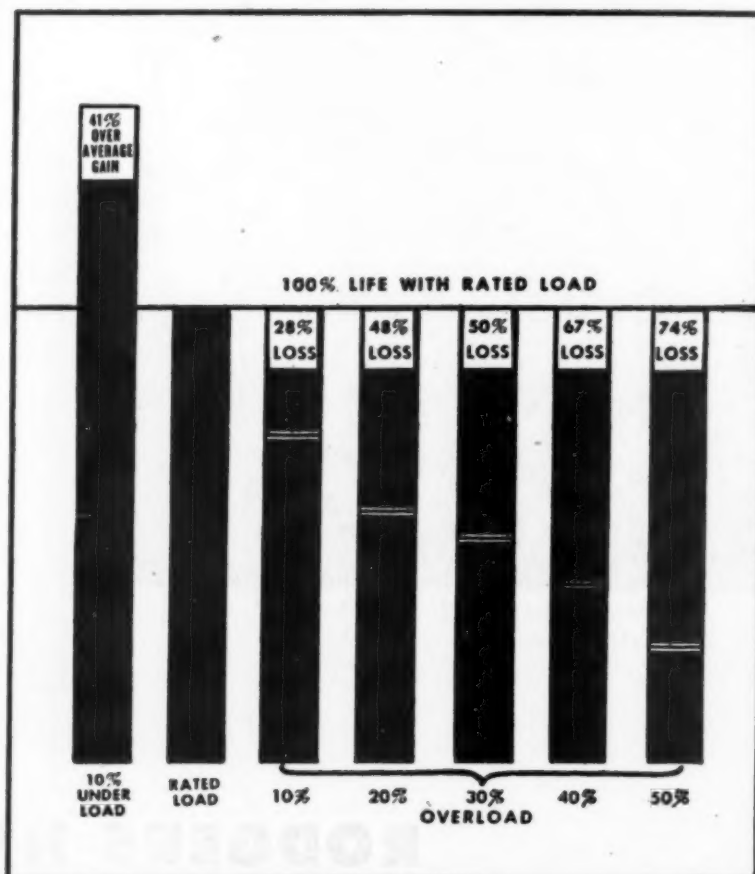
Experience indicates that wheel bearing lubrication intervals should not be extended beyond recommended mileages for most satisfactory service. Wheel bearings of "off-the-high-way" vehicles may require even more frequent servicing due to the severe service involved. This type of equipment is generally lubricated on an hourly, rather than on a mileage basis. Safe practice is to establish an interval of from 60 to 75 hours for the lubrication of front wheel bearings on these units. Units requiring removal of rear wheel bearings for lubrication should have this work performed at 500 to 750 hour intervals.

Proper wheel bearing adjustment is of extreme importance both from a performance and from a safety standpoint. Usual practice is to tighten adjusting nut until the wheel just binds. The nut is then loosened 1/6 to 1/4 turn, or to the first point at which the cotter pin can be inserted and still permit the wheel to turn freely. Where jam nuts are provided care should be taken to prevent further tightening of the adjusting nut

when tightening the jam nut. Wheels should be checked for ease of rotation after the adjustment is completed. Bearings adjusted too tightly will overheat with subsequent melting of the grease and possible early failure. Loose bearing adjustment permits pounding with possible chipping of the bearing. Manufacturers' instructions on actual service procedure for adjusting wheel bearings on each unit should be consulted.

Don't Overload

An item of wheel bearing care which is frequently disregarded is proper loading of the vehicle. The Timken-Detroit Axle Company has recently published information on the effect of loads on wheel bearing life. Figure I shows a Load-Endurance Chart for wheel bearings. It is to be noted that a continuous 50% overload on the bearing will result in a 74% loss of bearing life, or, in other words, the bearing will give only 1/4 of its normal, useful life. This is rather startling when it is considered that today vehicle overloading is probably the rule, rather than the exception. A further point to be noted





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is that a bearing overload does not necessarily mean an overload on the tires. Bearing overloading is very often caused by incorrect distribution of tire load between the two wheel bearings. The tire load on the two wheel bearings must be divided into correct proportion to each bearing's rated capacity. There is not

much the operator can do about this. He must place reliance in the design of the unit and the way in which the load carrying ability of the axle beam is balanced with the approved load carrying capacity of the wheel bearings. It is, however, definitely to the operator's advantage to eliminate overloading wherever possible.

How to Inspect Sheaves Used with Wire Rope

By A. J. MORGAN,
Chief Engineer, Wire Rope and Strand Division
John A. Roebling's Sons Company

PROPER inspection of wire rope must necessarily include examination of the equipment on which it is being used. In the majority of instances the cause of abnormal deterioration of wire rope is to be found in the machinery on which it is operating.

The principal items to be checked are:

1. Sheaves.
2. Drums.
3. Reeving.
4. General operating conditions.

Table I. Recommended and Minimum Diameters for Sheaves

Rope	Recom- mended Diameter No. Times Rope Diameter	Minimum Diameter No. Times Rope Diameter
6 x 7	72	42
6 x 19	45	30
6 x 30	45	30
(Style G)		
6 x 37	27	18
8 x 19	31	21
18 x 7	51	34

Sheaves

Points to be checked on sheaves are:

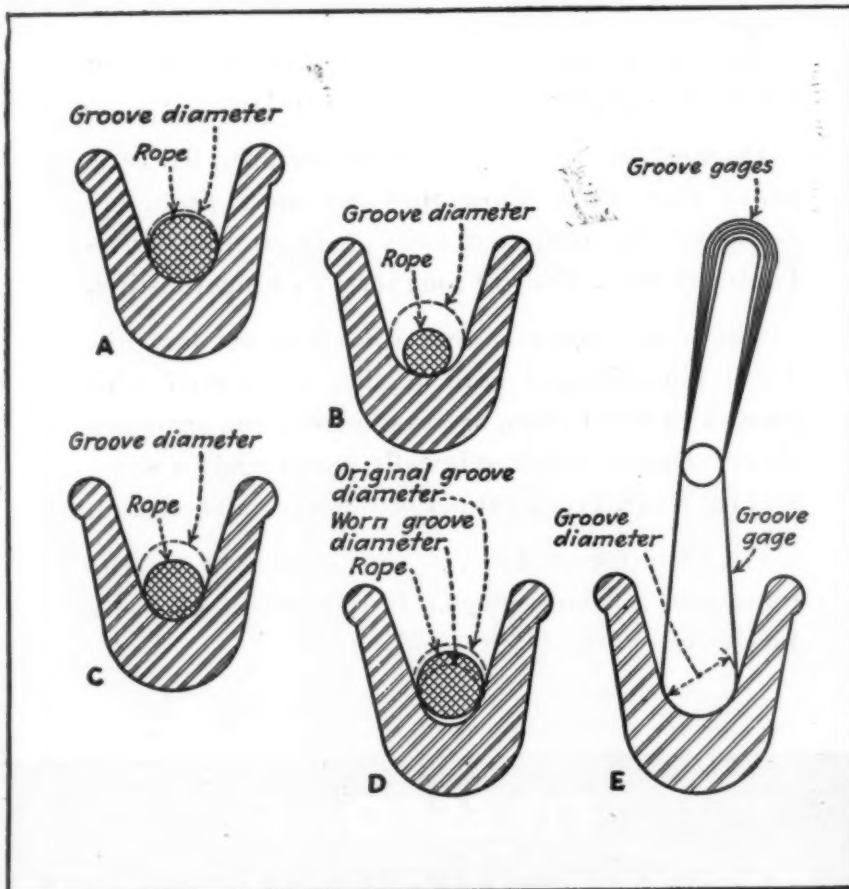


Fig. 1. Grooves should support a wire rope for nearly one-half its circumference, as in A. When a groove is too large, B, the rope tends to flatten under tension. C, this groove has worn to the decreased diameter of the rope. D, a new rope in a worn groove will be inadequately supported. Use a groove gage, E, to check grooves

1. **Size.** Measure the diameter of a sheave from bearing surface to bearing surface, not from flange edge to flange edge, because it is the radius of the bearing surface that governs the degree of bending to which the rope is subjected as it travels over the sheave. Table I gives the recommended and the minimum sheave diameters for various constructions of rope. (These recommendations apply to drums as well as sheaves.)

Since the rate of fatigue of wire is governed very largely by the radii of the bends which it must take in normal operation, it is extremely important that the recommended diameters be equalled or exceeded. A large amount of internal wear is caused by improper sheave (and drum) diameters, since the radial pressure on a wire rope increases in inverse proportion to the radius of the bend. As the radial pressure increases a crushing action takes place in the rope, which increases internal friction and causes nicking of one inside wire by another.

2. **Sheave Grooves.** The diameter of the bearing grooves of sheaves (and drums) must bear a certain definite relation to the diameter of the wire rope used in it. See Fig. I. As a rope passes constantly over the sheave, the groove is worn deeper and its diameter becomes constantly smaller until it is less than that of a new rope of listed diameter. When a new rope is placed in such a groove it will be forced down into the groove and be pinched out of shape. Hence, it will be subjected to extreme conditions of abrasion against the sides of the groove. Also, it will be forced out-of-round and therefore will become unbalanced.

On the other hand, a rope placed in a sheave groove of too great diameter will not be afforded proper support. Such a condition tends to allow the rope to flatten out as radial pressure is applied to it.

The ideal condition is that in which the wire rope receives support from the sheave groove around just less than one-half of its circumference. The rope is thus allowed freedom of action with a maximum of support. Gages for measuring sheave grooves can be obtained from any wire rope manufacturer.

Table II. Tolerance by Which Sheave Groove Diameter Should Exceed Rope Diameter

Nominal Rope Diameter, Inches	Recommended Tolerance, Inches
1/4-5/16	1/64
3/8-1/2	1/32
5/8-3/4	3/64
7/8-1 1/8	1/16
1 1/8-1 1/4	3/32
1 3/8-1 1/2	1/8
1 5/8-2	1/4

Table II gives the tolerances recommended for sheave grooves.

3. **Sheave Materials.** Sheaves of too-soft material will be cut by wire rope, and their bearing surfaces will become corrugated to fit the contour of the rope used over them. This will not exactly conform to that of the next rope to be used over them; therefore the new rope will be cut and worn by the corrugations. Where such a condition prevails the sheaves should be re-machined or, preferably, replaced with sheaves of harder material.

Such corrugation will occur more

readily if the sheave diameter is too small.

4. **Sheave Operation.** Defective bearings will cause sheaves to wobble or to revolve eccentrically and will set up a whipping action in the wire rope. Whipping will, of course, greatly increase the rate of fatigue and other deterioration of the rope.

Lawn mower rollers of wood construction aren't always conveniently replaceable today. A convenient wartime substitute is a length of pipe of proper diameter, the ends of which are plugged by welding discs of metal through which the spindle or shaft stubs have been inserted.



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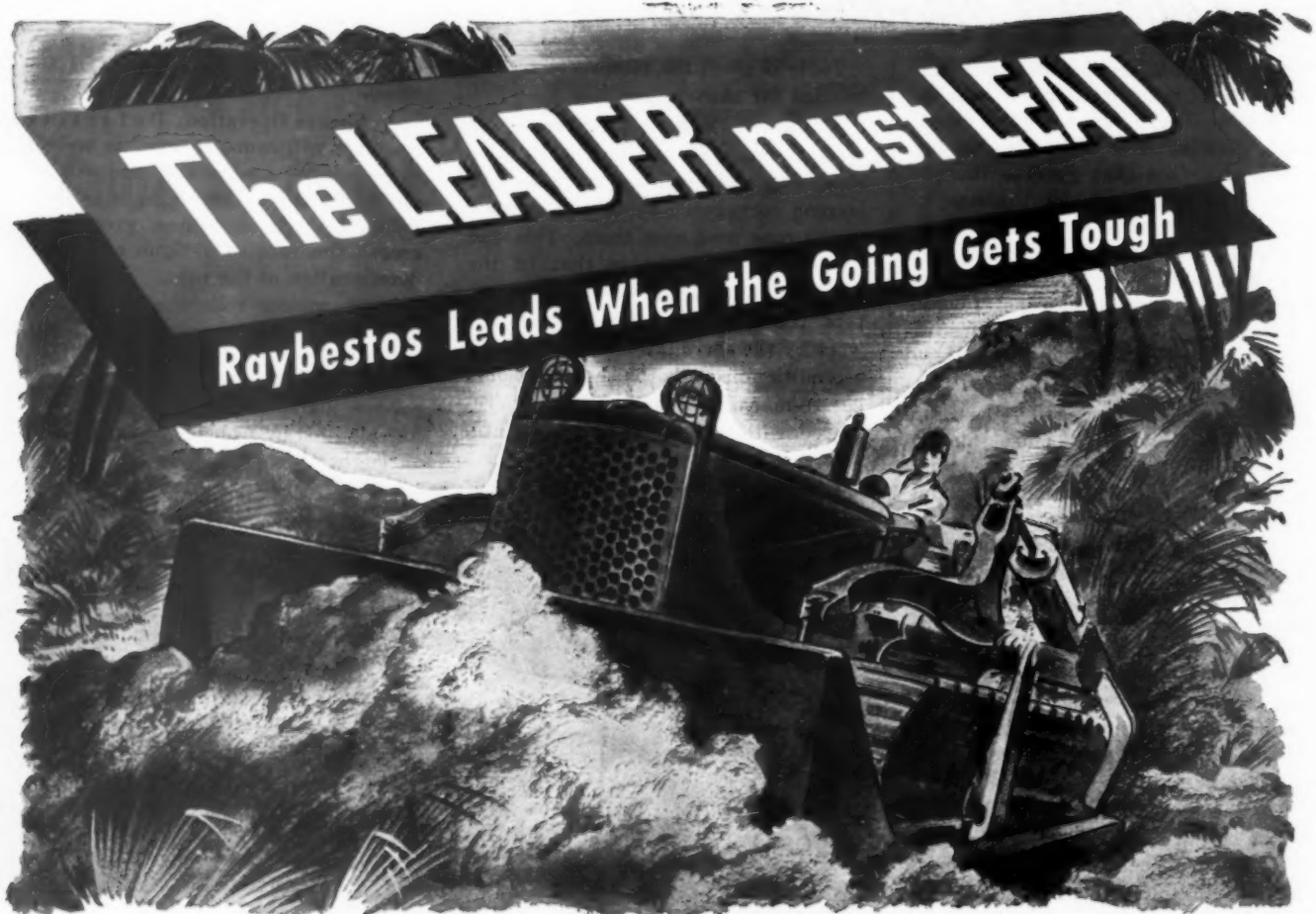
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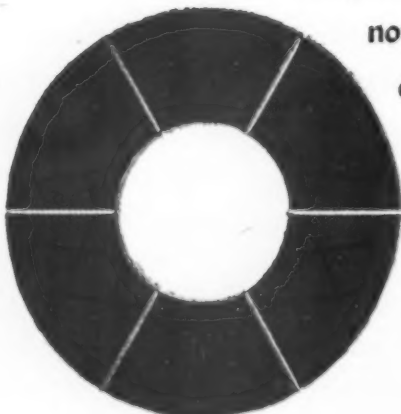


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California's Equipment Repairs Cost \$1,877,000 Last Year

Equipment

Wartime restrictions imposed by Federal directive because of shortages in materials and equipment, have created many difficult problems for the Equipment Engineer, it is noted in the California Division of Highways 14th Biennial Report.

The serious equipment shortage has entailed the continued operation of much old equipment which had served far beyond its economic usefulness. As a result of necessary frequent and extensive repairs to these old units, repair costs for the past two years exceeded the preceding biennium by approximately 9 per cent. Besides this increased repair cost, an additional loss occurred by reason of longer inactivity of equipment during repairs.

The drastic reduction in the acquisition of new equipment is best illustrated by a comparison of expenditures during the last two biennial periods. Between July 1, 1940, and June 30, 1942, expenditures for new equipment amounted to approximately \$2,030,000, most of which were confined to the 17 months preceding the war. Between July 1, 1942, and June 30, 1944, the total amounted to only \$172,000, a reduction of more than 90 per cent.

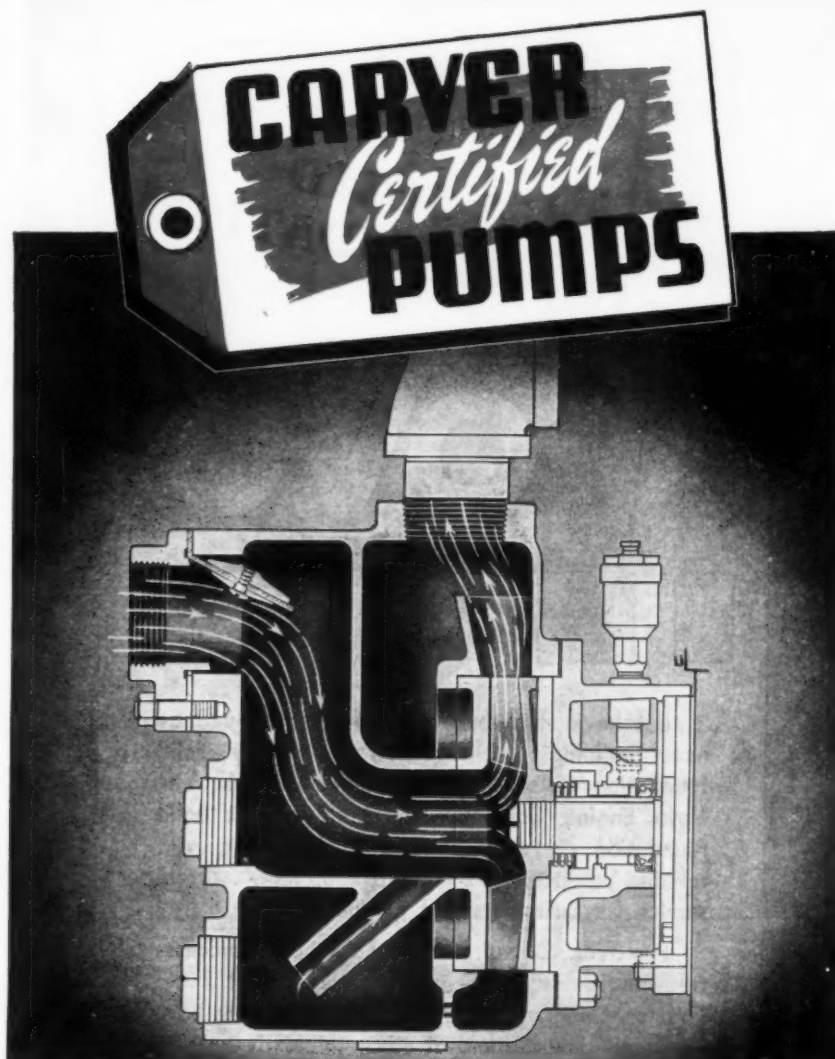
Approximately 40 per cent of this \$172,000 was made during the last two months of the biennium as the situation has been relieved to some extent recently by Federal authorizations for cars and trucks.

Financial Condition

War conditions have had a very detrimental effect upon the equipment rental system, resulting in a net loss of approximately \$191,000 for the biennium. Normally, the rental system makes the Equipment Department self-supporting by balancing rental income against the cost of repairs, administration and depreciation.

During the past two years, in addition to the greater cost of equipment upkeep, there has been a considerable decrease in rental income, due to several factors, which are directly attributable to the war. Division of Highways motor vehicle usage has been reduced in order to conserve gasoline and tires, and use of other equipment has been reduced to some extent because of the manpower shortage.

Rental losses also have been incurred by the longer periods required for repair which have resulted from difficulties in procurement of replacement parts and shop manpower deficiencies.



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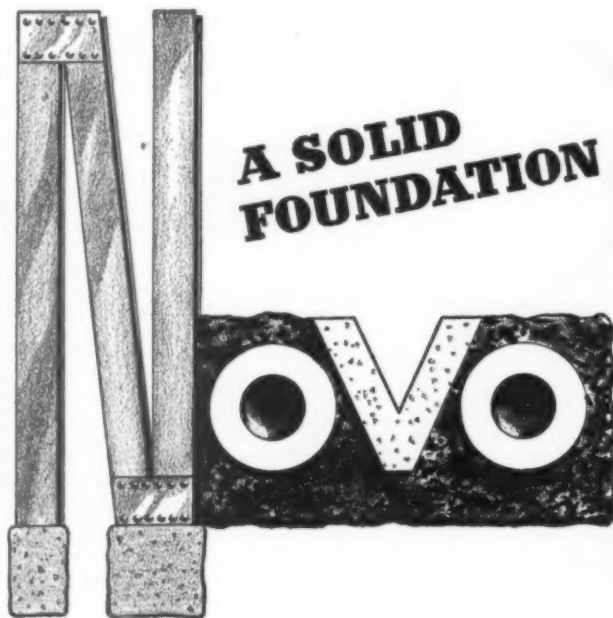
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In August, 1942, all equipment was placed on a shift rental basis. Until then, much of the maintenance equipment had been charged on a monthly basis. While this change is beneficial for accounting reasons, it also entails some loss in rental revenue.

The effect of all these factors has been a reduction of more than \$500,000 in rental income for the biennium. This loss and the increase of \$165,000 in equipment upkeep have been largely compensated by a \$615,000 decrease in depreciation which has been realized from the extended service of numerous units.

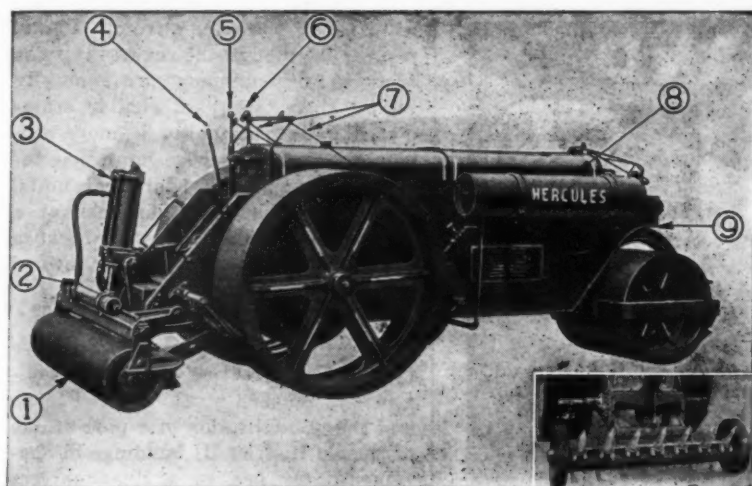
The following statement of operations shows the financial condition of the Equipment Department for each of the two years of the past biennium.

Consolidated Statement of Operations

	July 1, 1942, to June 30, 1943	July 1, 1943, to June 30, 1944
Equipment		
Administration:		
Materials and supplies	107	158
Service and expense	28,781	33,912
Salaries and wages	188,842	185,580
Headquarters equipment rental	12,035	12,837
Totals	\$ 229,765	\$ 232,487
Equipment Upkeep:		
Repairs of equipment	863,058	1,014,006
Transfer of equipment	32,659	31,812
Salvage (Cr.)	120	1,678
Stores adjustment (Cr.)	1,837	428
Stores expense	49,781	48,389
Shoe expense (Cr.)	792	10,478
Insurance premiums on equipment	29,337	21,811
Equipment damaged by accident and fire	19,674	17,062
Miscellaneous expense	2,282	2,041
Total operating cost	\$1,225,390	\$1,355,025
Equipment depreciation	605,318	673,123
Total equipment expense	\$1,830,708	\$2,028,149
Rental and income from other sources	1,860,899	1,807,246
Excess income over expense	\$ 30,191	\$ 220,903
Excess expense over income		\$ 190,712
Net loss for the biennium		190,712
Comparative Summary		
	13th Biennium	14th Biennium
Equipment repairs	\$1,713,357	\$1,877,064
Miscellaneous Expenses	224,131	241,100
Administrative Expenses	450,893	462,252
Depreciation Reserve	1,893,214	1,278,441
Total expense	\$4,281,595	\$3,858,857
Total income	4,200,261	3,668,145
Excess expense over income	\$ 81,334	\$ 190,712

Plans and Procedure

All rental equipment owned by the Division of Highways is apportioned to districts and other subdivisions in accordance with their ordinary needs. In emergencies, additional equipment



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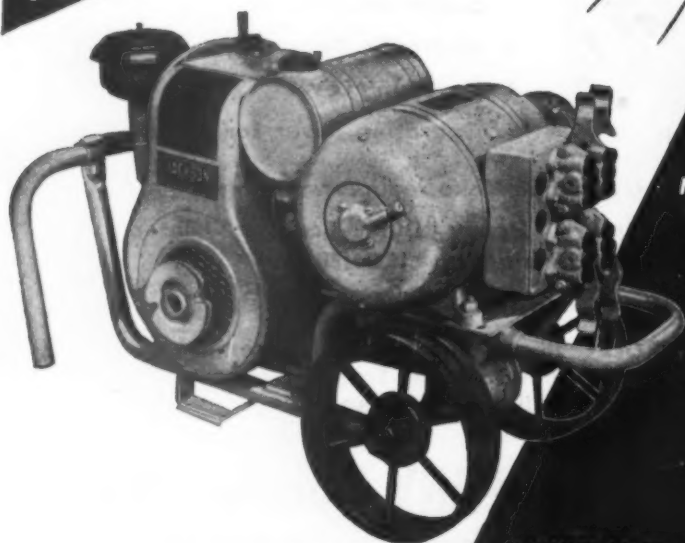
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is normally rented from outside sources. Although the rental rates for such outside equipment are generally higher than those for similar state-owned units, this policy is more economical than purchase and maintenance of numerous additional units. This policy, however, has been at a disadvantage since the war, because of the scarcity of privately owned equipment available for rental.

The only changes in equipment plants during the past two years have been the construction of a small additional truck shed at Shop 6 in Fresno and the rehabilitation of a part of one of the old District III buildings in Sacramento for use as a Headquarters Paint Shop. The following statement shows the shop space under cover and the value of rental equipment owned by the Division of Highways as apportioned to the districts on June 30, 1944.

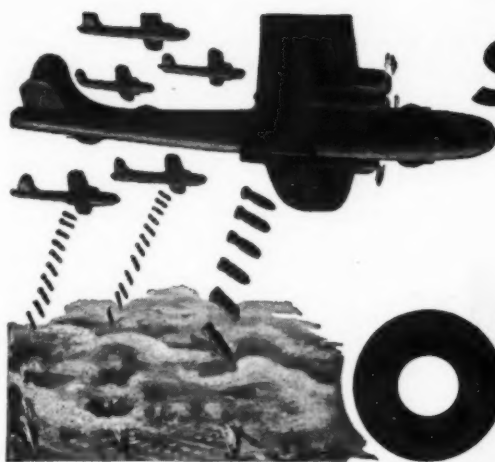
Shop No.	Location in shop	Square feet covered space	Inventory value of State-owned rental equipment
Headquarters, Sacramento	60,072	\$253,052	
1, Eureka	24,567	552,281	
2, Redding	21,108	955,956	
3, Marysville	None	626,772	
4, San Francisco	18,040	467,922	
5, San Luis Obispo	12,737	429,806	
6, Fresno	16,620	609,689	
7, North Hollywood	24,931	481,757	
8, San Bernardino	12,321	551,947	
9, Bishop	15,776	220,426	
10, Stockton	None	521,281	
11, San Diego	18,045	459,948	
		\$6,430,831	

The value of rental equipment shown as at Headquarters Shop includes units used by the Materials and Research Laboratory, Bridge, Maintenance and other departments of the Division of Highways located in Sacramento, as well as relief units which are kept for ready replacement wherever needed.

California Owns Equipment Valued at \$6,430,000

The inventory value of equipment owned by the California Division of Highways; as of June 30, 1944, was \$6,430,830. The 14th biennial report of C. H. Purcell, State Director of Public Works, lists the principal items of equipment owned by the Division and controlled by its equipment engineers, as follows:

Passenger cars, station wagons, and expresses (trucks up to 2-ton capacity)	1217
Trucks, 2 to 10-ton capacity	678
Air Compressors, gasoline	20
Air Compressors, diesel	13
Angledozer	83
Circulating oil heaters	24
Drills, for rock, also pavement breakers, air-gasoline	81
Graders, pull-type	133
Graders, tractor-type, power control, gasoline power	89
Graders, tractor-type, power control, diesel power	81
Kettles	237
Loaders for trucks, traveling, power	4



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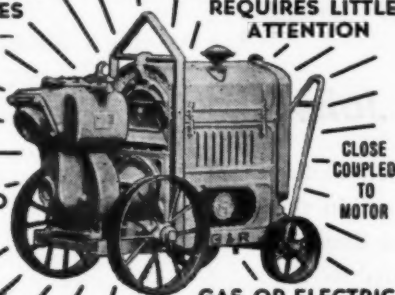
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PENDER, NEBRASKA



EXPERIENCE
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Sells 'em

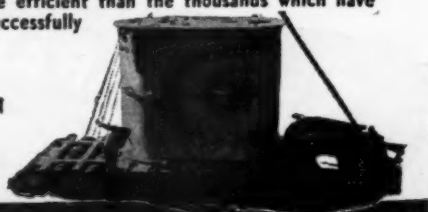
SAFE from Invasion is no idle boast today. The enemy has been driven from the Alaskan outposts and they dare not attack us here!

ROGERS TRAILERS have played a big part in fortifying our coastlines and they are fighting with our men overseas!

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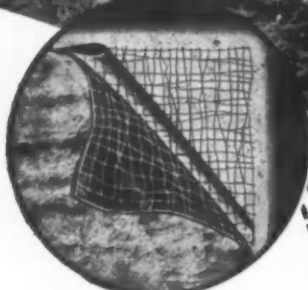
The ROGERS TRAILERS which will be available to industry when present war contracts are completed, will be even better-engineered and more efficient than the thousands which have been operated so successfully for many years.

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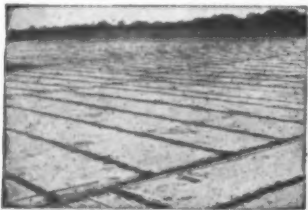


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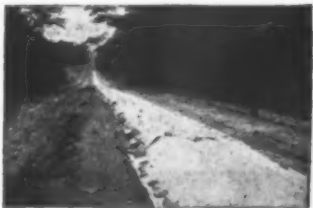
SISALKRAFT



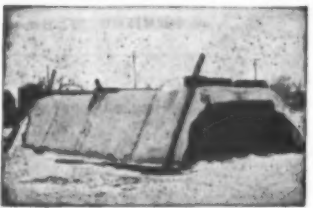
SISAL REINFORCEMENT GIVES STRENGTH AND TEAR RESISTANCE



PROTECTING SOIL CEMENT



PROTECTING ROAD MIX



PROTECTS MATERIALS STORED IN THE OPEN

BLANKETS
SAVE TIME,
MANPOWER
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On ALL Road Jobs!

UNMATCHED in their ability to hold moisture within the slab, SISALKRAFT Road Blankets have a time-proven record as the Number One concrete curing agent — producing denser, longer lasting concrete roads at low cost.

Savings in time, manpower and money are effected by the speed with which two men apply SISALKRAFT Blankets over the slab. No sprinkling — no burlap — just "let 'em lay." The concrete cures automatically! The slab is protected from weather and dirt! The blankets are used again and again.

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Loaders, bucket and belt, power....	9
Mowers, tractor-drawn, also attachments	13
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Paving Units, loaders and mixers, for asphalt	1
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Rollers, pull-type, multiple tires....	6
Scarifiers, attachments	43
Scarifiers, 4-wheel	34
Scrapers	28
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Shovels, diesel, ¾-cu. yd. or less....	2
Shovels, diesel, over 1-cu. yd.....	6
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Snow Plows, power-driven, Roto-blade	1
Snow Plows, power, road wideners..	2
Snow Plows, blade and V-type....	155
Tractors, wheel-type	69
Tractors, crawler, gasoline.....	37
Tractors, crawler, diesel.....	90
Trailers, pneumatic tires, cargo.....	51
Trailers, solid tires.....	9

New Equipment and Materials

New Sheepfoot Rollers

A new line of sheepfoot tamping rollers has been announced by the Baker Manufacturing Co., 506 Stanford Ave., Springfield, Ill., for use with Allis-Chalmers crawler tractors. The sheepfoot tamping roller will be put into limited production as war conditions permit. Features include: Heavily reinforced box-type welded steel frame; rollers that turn on axles which pass through lubricant-retaining tubes so that weighing fluids cannot come in contact with axles; self-aligning roller bearings on each side of roller; forged tampers with readily renewable heads to min-



Model 511 Baker Bulldozer on Allis-Chalmers HD-10 Tractor

imize tearing up of compacted material; shear type tamper cleaners, front and rear; and spring-cushioned drawbar. Each roller in its frame constitutes a unit. Tongue is removable. Dual and triple roll units are formed by using front and rear tie bars which permit rolls to oscillate independently of each other. A clevis on rear tie bar permits use of rolls in tandem. The tampers are available in single, double and triple roll units as standard units.



DENTISTRY FOR DIPPER TEETH!

P&H Electrodes help you cut maintenance costs . . . avoid costly delays and equipment lay ups . . . keep machinery working longer. Build up and hard-surface worn parts—repair-weld broken ones . . . right on the job with P&H Welding Electrodes . . . to save money and time.

There's a complete line to choose from—assuring the right electrode for every job. P&H Welding Electrodes are available in all sizes and types for repair-welding . . . for rebuilding, hard-surfacing to provide unusual resistance to wear, impact and abrasion. Let a P&H field engineer help you with your welding problems. Call your nearest P&H office today, or write for full information.

General Offices: 4496 W. National Avenue, Milwaukee 14, Wis.



HOW FLINK ONE MAN Material Spreader DOES BETTER JOB

**Spreads
Sand
Cinders
Chips
Calcium
Chloride**

Spreads forward or backward, in even layers, wet or dry materials, thick or thin, as desired. Spreads full or half width of street. Efficiently handles all materials up to 1". Built for tough road building and maintenance jobs, for ice control, for spreading lime.

Flink spreaders do a better job for definite reasons:

1. POSITIVE AGITATION by rugged, simple, finger type agitators.
2. ADJUSTABLE GATES, set before spreading, give accurate control of amount spread.
3. HI CARBON STEEL PANS scientifically placed and angled thoroughly "mix" material dropping through gates, deposit it in even layers on spreading surface. No thick and thin spots.
4. ELECTRICALLY WELDED. The Flink spreader is a rugged piece of commercial equipment, built of steel, for hard use.
5. FASTER. Spreads at 12 to 20 miles an hour. Can be operated by driver



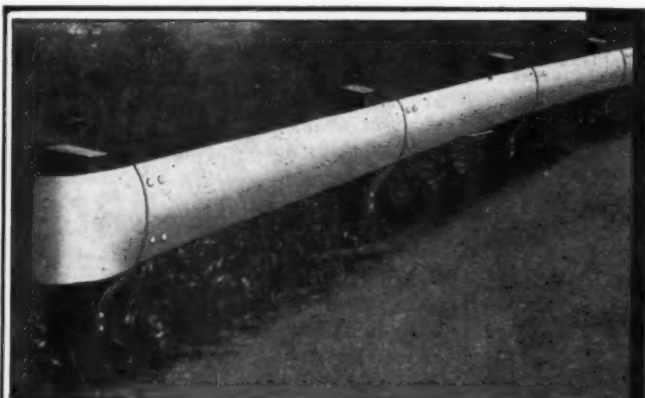
6. NO HELPER. The Flink is self-feeding. No shoveler on back to "restup" or "warm up."
7. DOES NOT LIMIT USE OF TRUCK. Truck can be dumped same as with regular end gate or spreader can be replaced by original end gate in 5 minutes.

Write for literature.

The FLINK COMPANY

508 VERMILION

STREATOR, ILLINOIS



Less to Install... Safer to Use TUTHILL GUARDS on Guard

SPLIT-second notice is not enough to warn motorists. The TUTHILL Guard gives the quick, long-view, with its greater visibility, due to its convex surface. Nor is simply a wall—of steel or brick—a symbol of safety. What kind of safety is a wrecked car? TUTHILL, on the other hand, takes the car in its stride, gives-in to the impact, goes back into position with spring-like action. Result? Car saved, with little or no damage. Guard saved, with little or no damage. Lives saved! If it does these things—does them better—why not TUTHILL? Why not?

Ask for complete details.

Pacific Coast Manufacturers and Distributors:
U. S. SPRING & BUMPER CO., Los Angeles, Calif.

TUTHILL SPRING COMPANY
761 W. POLK ST. CHICAGO 7, ILL.



EVERY DAY BRINGS US CLOSER

to Tokyo, and to the time when new and greatly improved models of Byers shovels and cranes will be available for delivery to you.

Byers will specialize in building excavators in the most popular sizes and containing carefully developed features that provide new operating and maintenance advantages which contractors, engineers and operators alike will readily appreciate.

Without sacrifice to Byers other war production schedules, certain new models have been built and operated on war jobs for several years.

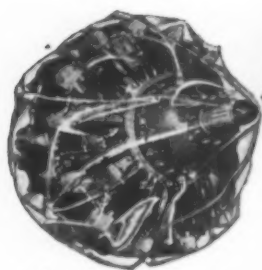
Now, with complete confidence in their sound values, we are planning quantity production on these new shovels and cranes as soon as physically possible.

Distribution will continue through independent, territorial construction equipment distributors of the highest type, in whom you may place your confidence.

BYERS

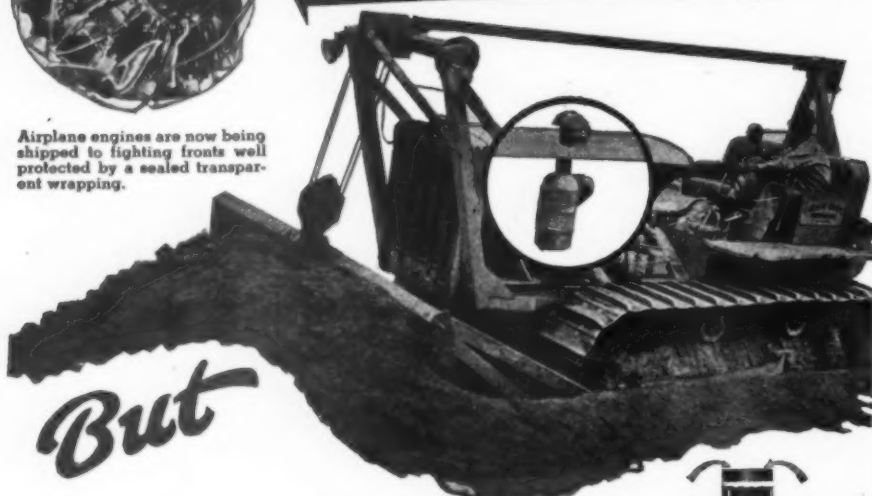
**CRANES
AND
SHOVELS**

DISTRIBUTORS THROUGHOUT THE WORLD



Airplane engines are now being shipped to fighting fronts well protected by a sealed transparent wrapping.

**THIS is ONE WAY to
PROTECT YOUR ENGINES
Against Dust & Grit . . .**



But

ENGINES IN ACTION Need DONALDSON- Oil-Washed-Air PROTECTION

Engines in operation cannot be sealed air-tight against the ravages of dust and grit . . . because engines must breathe. But they receive the same absolute protection when they are equipped with Donaldson Oil-Washed Air Cleaners and Donaldson Positive Crank Case Ventilation.

Donaldson installations are standard equipment on gas and diesel operated excavating and construction equipment as well as stationary power units, farm implements, tractors, trucks and busses, made by the world's foremost manufacturers of these lines.

Donaldson protection for your engines will go a long way in keeping customers satisfied by maintaining operating efficiency and lengthening engine life.

The Donaldson Air-Cleaner engineering staff, with the longest record of experience in the industry, is available to you for consultation on your dust problems. Write us.

DONALDSON COMPANY, INC.
666 PELHAM BOULEVARD SAINT PAUL 4, MINN.

WORLD'S FIRST MANUFACTURER OF AIR CLEANERS



New Portable Bituminous Supply Tank

A new type supply tank has been brought out by the Wood Manufacturing Co., 816 W. 5th St., Los Angeles, Calif. Designed for use with the Wood Roadmixer, the tank can be used with other traveling mixing plants and for any off-the-highway work. Built for carrying road oils, emulsions, and cut-backs, this supply tank can be used for the transfer or temporary storage of practically any fluids. The 3000 gal. tank is divided into 1000 and 2-

000 gal. compartments. A 3 in. Roper pump, powered with either a Chrysler or Ford industrial engine, is mounted at the rear. Construction features include tandem rear wheels mounted on a walking beam and front wheels mounted on a center pin. Accessory equipment available at extra cost includes spray bar, insulation and heating unit, and wheel tracking system. Specifications: Height overall, 9 ft., 6 in.; width overall, 8 ft., 5 in.; length, including tongue, 27 ft., 6 in.; weight, 9640 lbs.; tire size, 10:00x20.

New Latch for Safety Hooks

A newly designed latch for its safety hooks has been announced by the Thomas Laughlin Co., Portland, Me. It is stated the latch gives 80 per cent of the full throat opening and its proper operation decreases the possibility of overloading and overcrowding. The latch is made of pressed steel in the smaller sizes and cast bronze in the larger. This im-

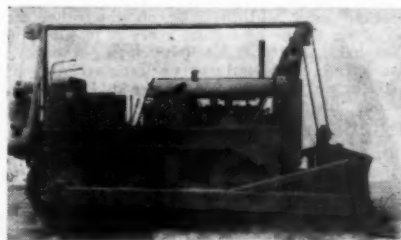


Improved latch for safety hooks

proved latch is riveted at the neck of the hook to a cam which is an integral part of the hook forging. The latch is actuated by a stainless steel wire spring which coils around the hub of the cam on each side and extends down the inside of the latch. Safety hooks with these new latches are modifications of standard eye, straight shank and swivel types with safe working load capacities from ½ to 15 tons.

New Bulldozer

Proven in action on the world's fighting fronts where hundreds are being used by the armed forces the new cable dozercaster of Gar Woods Industries, Inc., Detroit 11, Mich., is now available in limited quantities for essential civilian use. This dozer of the angling blade type is designed to place the moldboard close to the radiator for better balance and easier pushing. Tilting of the moldboard is achieved by the use of a double trunnion on the main frame. The sheaves



Cable Operated Dozercaster

are of steel, hardened in the rope grooves and mounted on hardened and ground shafts with roller bearings for longer life. For operating the doze-caster, Gar Wood Industries offers its cable control unit in both single and double drum type. The doze-caster is mounted on an Allis-Chalmers HD14 diesel tractor.

Soil Stabilizer Latest P&H Development

From the Harnischfeger Corporation, builders of P&H earth moving machinery, comes word of an entirely new machine for use in the building of low-cost all-weather roads. A natural outcome of the rapid developments in soil-stabilizing techniques, this new machine combines in one operation all the necessary functions in soil preparation. Known as the P&H single pass stabilizer, it promises efficient, low-cost processing of native soils for the construction of base courses, light traffic roads, etc. Having tested the machine thoroughly under varied conditions and in different parts of the country, P&H engineers report that it has been received with enthusiasm by many leading



Do not gamble with light and safety. DIETZ LANTERNS give dependable light with safety—for over a century.



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TORCHES



Replace DANGER with SAFETY

Place DIETZ LANTERNS on guard for every emergency use. They faithfully guide the way, night after night, without diminishment of light.

DIETZ LANTERNS will not fail or falter as long as a drop of oil remains to burn. Many models will give light and safety for an entire weekend with plenty of kerosene left to spare.

Keep your DIETZ LANTERNS in good service—ready for use the moment needed.

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NEW YORK

Output distributed through wholesalers exclusively.

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FOLDING MOLDBOARD



Burch Truk-Patrols are now equipped with a folding moldboard. The cutting edge can be set and securely held at any desired operating position from cutting to scraping and can be folded back out of the way for transport. There are many other new and valuable features found only on the Burch. Full HYDROMOTOR control means the control with a "Feather Touch". Write for bulletin.

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The BURCH CORPORATION
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Equipment Since 1875
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Superior Quality
BLADES
AND CUTTING EDGES

For any make of machine
Motor Graders, Motor
Scrapers, Scrapers, Drag-
Bulldozers, Backfillers,
Wagon Scrapers, Trail
Bulldozers, Trail Blasters,
Carryalls. Also—

CUTTING EDGES
WEARING BOOTS
BACK SLOPERS
EXTENSION BLADES
MOLDBOARDS
and
SCARIFIER TEETH

50 years of manufacturing blades has developed for you a special steel, milled through our own rolls and forged at the edges to give that extra wearing quality you need.

All widths lengths, and thicknesses. **SHUNK** ready to fit your machine.

Consult your internationally recognized Blade Specialists. Write for special bulletins, giving type and name of machines you operate—get set for Blades early.

Shunk
MANUFACTURING COMPANY
Established 1854
BUCYRUS, OHIO



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HERCULES
DELIVERS
ALL THESE
features

CENTER-LIFT HOIST

REVERSIBLE
TAILGATE HARDWARE

PISTON-TYPE
CONTROL VALVE

HOIST MOUNTS
ABOVE FRAME

EASY-REACH
TAILGATE LEVER

ACCESSIBLE
HOIST CYLINDER

DASH CONTROLS FOR HOIST
AND TAKE-OFF

PATENTED TIRE
AND TOOL PACK

Bigger payloads unloaded faster—less maintenance—greater profits—these are the advantages of Hercules construction . . . advantages that make Hercules dump bodies worth waiting for!

While you're waiting, your Hercules distributor can be of service, keeping your present equipment in top working order. He has the mechanical facilities, the replacement parts and the trained personnel needed to maintain your overworked equipment.



HERCULES STEEL PRODUCTS COMPANY . . . GALION, OHIO

**PORTABLE
ASPHALT PLANTS**
High Production—Low Cost



THE McCARTER IRON WORKS, INC.
NORRISTOWN, PENNA.

LA CROSSE

**Heavy Duty
Machinery Trailers**
Built by

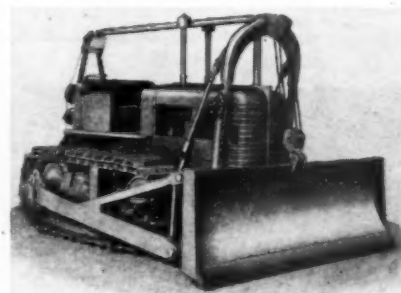
**LA CROSSE TRAILER
& EQUIPMENT CO.**

LA CROSSE WISCONSIN

highway authorities. Results of these tests are available to interested parties. Information may be obtained from the Harnischfeger Corporation, Milwaukee 14, Wis.

New Cable Controlled Bulldozer

A line of cable-controlled bulldozers, grade builders and power control units made exclusively for Allis-Chalmers HD-14, HD-10 and HD-10W tractors has been put on the market by The Baker Mfg. Co., 506 Stanford Ave., Springfield, Ill. Features include: Sturdy, reinforced tubular arch; rugged constructed box-welded moldboard; 5-position side arms which permit tilting of blade up to 10 in. on bulldozer and 12 in. on gradebuilder from a perpendicular position; 42 in. blade lift above ground on bulldozer, 50 in. on gradebuilder; blade drop below ground level limited only by length of cable. The power control units feature differential or self-energizing brakes whereby the dead end load assists the spring in setting the brake and is arranged so that the differential factor increases as band lining wears; "air-conditioned" cone type clutches and



Model 511 Baker Bulldozer on Allis-Chalmers HD-10 Tractor

band brakes are employed; brakes have 3 in. bands; all adjustments made from rear; drum barrel has curved contour at anchor end of drum. Power control units are made in heavy duty double drum and single drum types for rear mounting on Allis-Chalmers HD-14 and HD-10 tractors, double and single drum medium duty units for HD-7 tractors and a single drum front mounting type for HD-14 and HD-10 tractors.

New 2-Piece Dipper Tooth

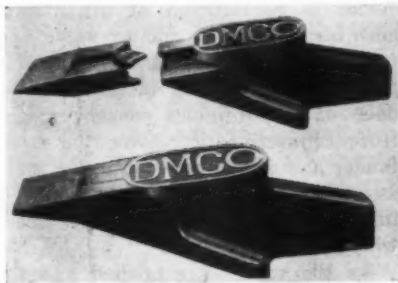
A new 2-piece tooth for shovel dipper and buckets has been placed on the market by Daniels-Murtaugh Co., 625 C Ave., N. W., Cedar Rapids, Ia. The two parts of the "Wear-Sharp Tooth" (patent pending), shown, are designated as the "Penetrator Point" and the "Weldapter." The design is

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stated to make it extremely easy to replace the point, which is double-keyed to the Weldapter and tack-welded. When the point becomes worn, it is readily removed and a new



"Wear-Sharp Tooth"

point installed by simply slipping it on the Weldapter and tack-welding at several points along the side and across the end where the parts join. The welds hold the point in place only. The double-key supports, one lengthwise and one crosswise of both parts, take all the digging stresses upward and downward, as well as side thrusts and impact shocks. The Penetrator point has a sharp thin cutting edge. These points are high quality heat-treated alloy steel forgings.

New Loader

A loader, equipped with 180° swinging boom which enables it to load trucks from either side without backing or turning the entire machine, has been developed by the Jaeger Machine Co. Crowding, hoisting, swinging and dumping are accomplished in one rapid, continuous movement. Power controlled buckets enable operator to control dumping as desired and to close bucket while it is being returned to loading position. Two speeds for boom operation are available, independent of traction. The machine is equipped with 65 hp. gas or diesel engine. It has front wheel drive through big pneumatic-tired wheels which carry 80% of the load, and low gear traction speed of $\frac{3}{4}$ m.p.h. It has six forward and six reverse travel speeds up to 15 m.p.h. Vickers power steering is standard. Buckets of $\frac{1}{2}$ to 2 cu. yd.-size are quickly interchangeable. Crane booms of up to 25 ft. length can be installed as an attachment. The machine was originally developed for the U. S. Navy and large industrial war plants where many are now in use. Complete catalog describing the "Fleetfoot" Loader may be obtained by writing The Jaeger Machine Co., 223 Dublin Ave., Columbus 16, O.



"BUILT to do the JOB"

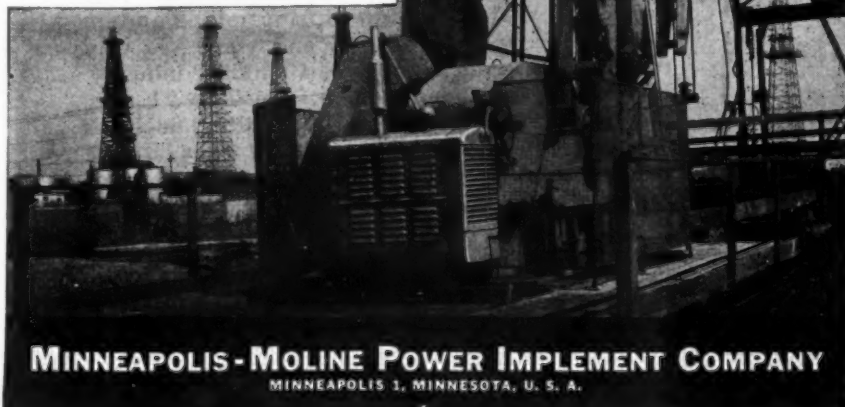
Stamina—the ability to "take it" for long periods of real tough going doesn't come as an accessory to Oil Field Engines. You can't buy it as an extra, it's either designed and built into every part of the engine or it isn't there at all.

MM Oil Field Engines don't have to be coddled because they have all the performance features "built-in"—Features that guarantee real low cost performance under tough conditions—Features that will give you assurance of 24 hour operation year in and year out in fair weather and foul—Features that will give you low cost, efficient, trouble free operation. Force-feed lubrication, valve-in-head design, high turbulence combustion chamber, controlled cooling, unit construction, automatic magneto cutout, automatic temperature cutout, flyball type variable speed governor, entirely enclosed in crankcase, oil wash air cleaner and ample size oil filter—these features and many others are "built-in" on every MM oil field Engine.

MM Oil Field Engines are built in 8 sizes to fit most every oil field application:

165-4A, 3 $\frac{1}{2}$ x 4, 4 cyl.	CUA, 4 $\frac{1}{4}$ x 5, 6 cyl.
206-4A, 3 $\frac{1}{2}$ x 5, 4 cyl.	HUA, 4 $\frac{1}{2}$ x 6, 6 cyl.
KUA, 4 $\frac{1}{4}$ x 5, 4 cyl.	MEU, 8 x 9, 4 cyl.
LUA, 4 $\frac{1}{2}$ x 6, 4 cyl.	NEU, 8 x 9, 6 cyl.

For Complete Information on MM Oil Field Engines, Write
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VULCAN PAVEMENT AND CLAY DIGGING TOOLS

ARE MADE in a complete line of sizes to fit all standard compressed air hammers.

Send for NEW Vulcan illustrated CATALOG today.

VULCAN TOOL MFG. CO.
 QUINCY, MASS.

Reliance

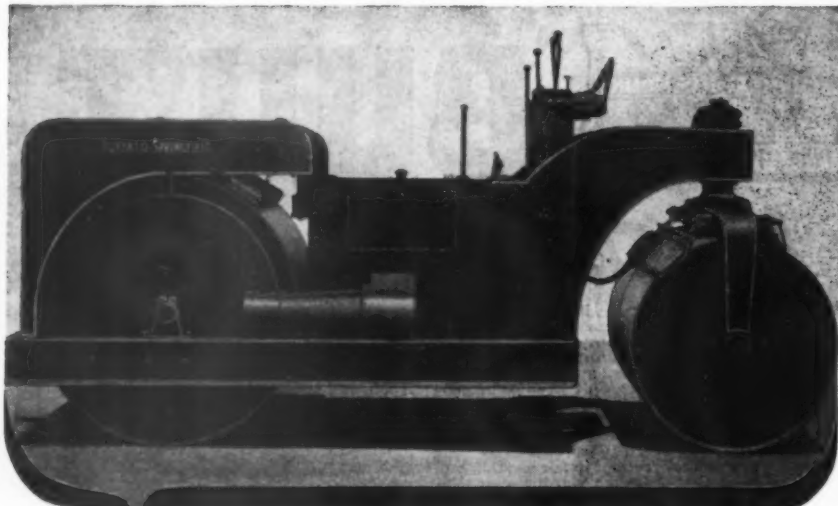
CRUSHING, SCREENING and WASHING UNITS

● Up to 2000 Tons a Day ●

Crushers	Bins	Drag-Lines
Elevators	Pulverizers	"GAYCO"
Sweepers	Feeders	Centrifugal
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 Kingston, N. Y.

Canadian Representatives: F. H. Hopkins & Co., Ltd.
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you always see more
Buffalo-Springfield Rollers
on resurfacing jobs

THE TRANSVERSE MOUNTING of the engine and simple, bevel gear drive provide such smoothness in reversing and freedom from vibration that they are ideal for finishing bituminous surfaces. Large, wide rolls combine high compression with large capacity. Watch Buffalo-Springfield Tandem Rollers, talk to their owners and you'll see why they are preferred by the road building industry. In addition to tandem rollers from 2 to 21 tons, the line of Buffalo-Springfield rollers includes three-wheel rollers from 6 to 12 tons, 3-axle tandems from 9 to 17 tons and trench rollers for widening work.



THE BUFFALO-SPRINGFIELD
ROLLER COMPANY Springfield, Ohio

**The Oldest and Largest Builder of Road
Rolling Equipment in America.**

**Tractor-Loader Combination
for Bridge Painting**

Hinds County, District 5, Mississippi, is using a "Caterpillar" diesel D4 tractor with Trackson traxcavator as a portable platform for spray painting bridges.

While the compressed air apparatus can be in a separate truck as is shown in the illustration the county engineers intend in the future to mount the compressed air apparatus on the front of the tractor to make the com-

bination a self-containing portable bridge painting unit.



Bridge painting unit on job near Terry, Miss.

Traffic Pattern Marker

A useful traffic pattern marker devised by V. G. Hofer, Chicago Park District Engineer, is described in the February Highway Highlights. The device is constructed of 5-gal. can, hose connections, a master valve and four secondary valves. The can is filled with water and fastened to the door of an ordinary passenger car. Hose connections run over the front fender and down to within a few inches of the pavement at two points a little wider apart than the front wheels.

As the valves are opened and the car is driven along the normal traffic flow pattern, the water drips on the pavement forming lines for work crews to follow.

The following advantages are claimed for the marker: (a) It defines lanes, no matter how complicated, to the natural movements of the drivers; (b) It saves considerable time in laying out work, especially at curves; (c) It reduces traffic delays due to the saving of time in laying out the markings; (d) It acts as a safety device in that smaller areas are closed to traffic and further that workers do not have to cross traffic as often as formerly to check movements; and (e) The cost of the device is negligible.

New Post Hole Digger

A post hole digger operated from the front end of any type wheel tractor has been added to the line of the Jaques Power Saw Co., Denison, Tex. the power to drive the shaft is ob-



Power post hole digger

tained from the tractor take-off pulley. The bit is raised or lowered by means of a crank-operated chain. A hand lever at driver's seat controls the operations. The bit has a speed of 300 r.p.m.

Obituaries

Abraham K. Fleschner, former president of Albert A. Volk Company, a New York City excavating firm, died recently age 57. He was with the Volk Company for 29 years, resigning in 1944. This company recently has engaged in demolition work. It also did the excavating and foundation work for the triborough and Goethols bridges in the New York area.

Leonardo Suzio, 78, highway contractor, died March 16 in Meriden, Conn. He was president of L. Suzio Construction Co., Suzio Trap Rock Quarry Co. and Work Hill Trap Rock Co.

Robert H. Richards, 101, oldest graduate of Massachusetts Institute of Technology, died March 27, in South Natick, Mass. He was a member of the class of 1868, the first to be graduated from M.I.T. Previous to his retirement in 1914 as professor emeritus, he was for 46 years a member of the institute faculty and for 41 years head of the department of mining engineering.

James W. Mutch, 66, acting county engineer of Spokane County, Washington, died recently in Spokane. He had been a member of the county engineer's staff since 1928.

Dr. Franklin C. Snow, 62, dean of School of Engineering of Georgia Tech, died March 2. He had been connected with Georgia Tech for 26 years.

Varnum P. Curtis, 67, died recently in Worcester, Mass. He was employed for many years in bridge construction work in Massachusetts and New York City.

John J. Kennedy, contractor, died March 30, in New York City. He was a member of the firm of Powers, Kennedy Construction Co. He had been in the contracting business in New York City and in Carbondale, Pa., for 50 years.

John S. Laughlin, 57, consulting engineer to Queens Borough, New York City, from 1939 to 1942, died March 12 in Seneca Falls, N. Y., where he was engaged on a Navy contract.



... AND OTHER REILLY ROAD AND AIRPORT MATERIALS

- PLASTUVIA
Crack and joint filler for concrete and brick pavement
- CREOSOTED GUARD RAIL POSTS
- CREOSOTED BRIDGE TIMBERS
- CREOSOTED PILING
- BRIDGE PAINT
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- WOOD PRESERVATIVES
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A REILLY engineer will be glad to discuss with you any road construction or maintenance problem.

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The ONLY insulated tube fired kettle with a completely removable heating unit (for quick and easy cleaning). The ONLY kettle with the burner INSIDE. Now available on pneumatics (and with mud guards too at slight extra cost) on high priority orders. Send for FREE Bulletin No. 260HR. For paving tools and accessories write for Leaflet No. 501RR.

AEROIL BURNER CO., INC.

WEST NEW YORK, N. J.

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South Bend GUTTER-SNIPE

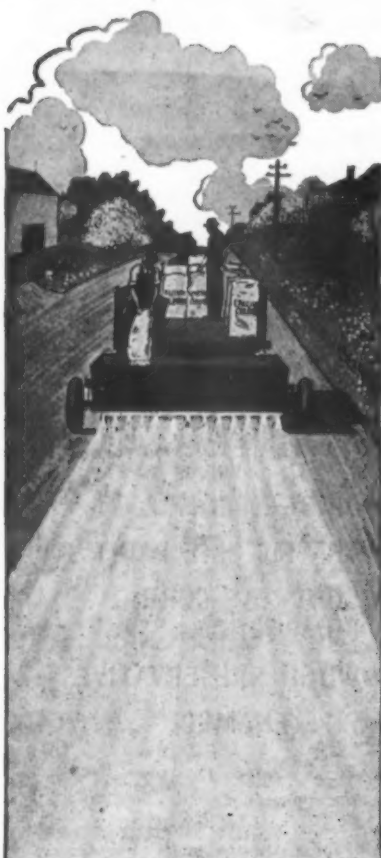
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Substantial road improvement is the reward of the highway official who conditions his gravel roads early, while moisture is still available for proper shaping and compaction. Further reward comes to those who apply calcium chloride early to hold the moisture which binds the fine cementing materials. This work should be done before these essential binder soils can blow away as dust.

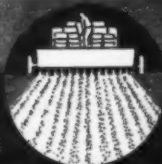
Too little has been said about the use of calcium chloride to prevent evaporation of the roadbed moisture—so essential to maintain compaction. Early road conditioning and early application of calcium chloride will work wonders. Bulletin 29 tells how—it is sent on request.

CALCIUM CHLORIDE ASSOCIATION
4145 Penobscot Bldg., Detroit 26, Mich.

Dust is the cement in your gravel road

Save it with

CALCIUM CHLORIDE



Ray S. Munson, 49, former county engineer of Goodhue County, Minnesota, died recently in Red Wing, Minn. He became county engineer in 1943 succeeding the late J. A. Prior. Previous to that he had been assistant county engineer since 1920.

W. M. Barber, 73, for many years surveyor of Claiborne Parish, Louisiana, died March 23 in Homer, Ia.

William H. Arrell, 76, formerly a general contractor in Minneapolis, Minn., died recently in that city.

Charles W. Bosler, 65, construction engineer, formerly connected with the Pennsylvania State Highway Department, died recently in Phoenixville, Pa.

Frank J. Moran, 55, highway contractor, died recently in Omaha, Neb. He owned and operated the Moran Construction Co., Omaha, for 23 years.

LaVerne J. Ruddock, 66, for 13 years city engineer of Wheaton, Ill., and later project engineer for PWA and FWA in Chicago, died recently in Wheaton.

With the Manufacturers and Distributors

J. H. Dykstra New Advertising Manager for Barber-Greene

Barber-Greene Co., Aurora, Ill., has announced the appointment of John H. Dykstra as advertising manager. Mr. Dykstra, formerly with Mumm-Mullay & Nichols, Inc., Columbus, O., advertising agency, succeeds Blaine S. Britton, who has resigned to go into business for himself doing photographic and publicity work in the construction and allied fields.

F. G. Nunneley Becomes General Sales Manager Powell Equipment Co.

Fred G. Nunneley, Canadian Sales Manager of Caterpillar Tractor Co., Peoria, Ill., since 1935, has resigned his position to become general manager of the Powell Equipment Co., Ltd., of Winnipeg, Canada.



F. G. Nunneley

Mr. Nunneley, a native of London, England, came to America in 1909. During World War I he served with the Canadian Expeditionary Force in France. In 1920 he became associated with the Ford Motor Co. of Canada, first as power farming head and later as a dealer for that company. In 1928, Mr. Nunneley became a district representative in the Canadian territory for "Caterpillar." He was appointed assistant sales manager in 1931 and in 1935 became Canadian sales manager.

Ward Keener Promoted by Goodrich

The appointment of Ward Keener as assistant to the president of The B. F. Goodrich Co., Akron, O., was announced March 24. The position had been assigned to Mr. Keener before Company President John L. Collyer was appointed Special Director of Rubber Programs on March 21. Mr. Keener joined the company in 1937 and has since served in a wide field of activities. In 1942 he became director of business research, and the following year was appointed assistant to the vice-president for finance.

S. L. Myers Named General Sales Manager

S. L. ("Sid") Myers, formerly vice president in charge of export sales, La Plant-Choate Manufacturing Co., Cedar Rapids, Ia., has been appointed vice president and general sales manager, succeeding H. H. Buchanan, who resigned. Mr. Myers started with La Plant-Choate as a helper in the machine shop in 1923. After working in the shop, he served as traffic manager, purchasing agent and export sales manager, in addition to being responsible for government sales. On Aug. 31, 1943 he was advanced to the position of vice president, in which capacity he has continued to serve until his recent appointment as general sales manager.



S. L. Myers

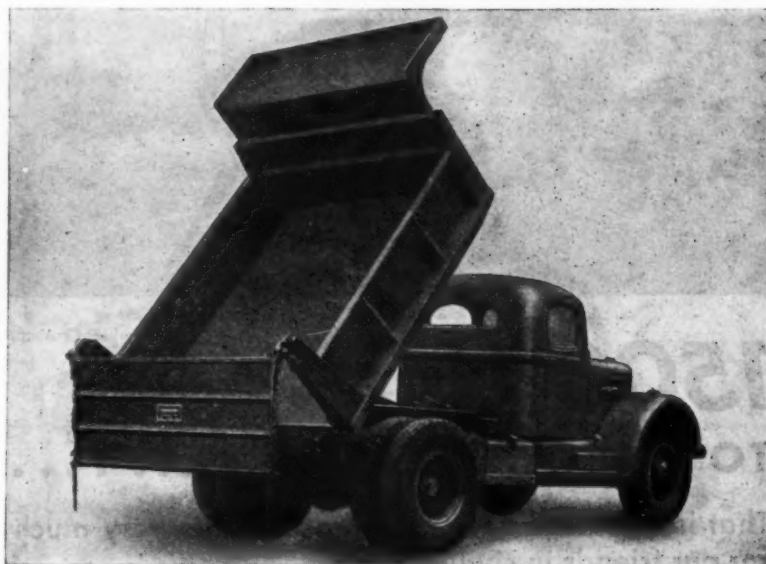
Worthington Adds Six Distributors

Worthington Pump and Machinery Corporation, Harrison, N. J., has added six distributors to its Construction Equipment Department. They will handle the regional sales of Worthington's Blue Brute portable compressors and air tools. They are as follows: Atlas Equipment Co., 722 Oliver Bldg., Pittsburgh, Pa.; Carolina Tractor & Equipment Co., Hillsboro Street Extension, Raleigh, N. C.; Chicago Construction Equipment Co., 13912 South Halsted St., Chicago 27, Ill.; Lakesboro Machinery & Supply Co., 400 Laketon Ave., Muskegon, Mich.; Phillippi-Murphy Equipment Co., 360 Hoover St., N.E., Minneapolis, Minn.; Olson Manufacturing Co., 2223 Fairview Ave., Boise, Idaho.

Eight Promotions by Caterpillar

Caterpillar Tractor Co., Peoria, Ill., has announced the advancement of eight men in the organization's Parts Department. M. T. Deames, a member of the Company since 1929, has been named new Assistant General Parts Manager. Assisting Mr. Deames as Parts Managers will be A. H. Yingst, for Export and Governmental Sales; T. H. Hodgins for the Central Sales Divisions; C. M. McKnight for the Western and B. W. Kramm for the Eastern Sales Divisions. Other appointments include E. L. Mason, H. F. Haven and C. D. Byrns to the positions of assistant parts managers of the Central, Western and Eastern Sales Divisions respectively.

MARION CONTRACTORS' BODIES ARE "TOUGH BABIES"



Yes, they are built to take a whale of a lot of punishment without whimpering.

Like all MARION Bodies and Heavy Duty Hoists, they give exceptional service in the construction and maintenance of public highways and streets. Choose from a complete line of standard MARION equipment, or if you have a specialized hauling problem which calls for bodies made to your specific requirements, MARION Engineers will work out the designs with you.

See Your Local Distributor or Write
THE
MARION METAL PRODUCTS CO.
BODY and HOIST DIVISION, MARION, O.

Walter Spiva New Mississippi Highway Director

Walter Spiva was recently appointed Director of Highways, Mississippi State Highway Department, where he succeeds E. D. Kenna, who has accepted an important post in the oil industry. Mr. Spiva brings to his new job a varied technical and executive experience. In 1942-43 he served on the Army Air Forces Technical Training Command instruction staff at Keesler Field. In 1943 he became director of civilian training at Jackson Army Air Base.

Wickwire Spencer Elects Bussman Vice President

A. G. Bussmann has been elected vice president in charge of sales, Wickwire Spencer Steel Co. Currently the company is planning greatly expanded postwar sales activities. In his new position Mr. Bussman will have complete charge of all sales and merchandising operations of Wickwire Spencer and the company's subsidiaries. Mr. Bussman previously was assistant to the president. He has been associated with the company since 1930.

GRUENDLER CRAFTSMANSHIP SERVING INDUSTRY 60 YEARS



Partial Shipment of
Gruendler Portable Crushers

1500 Units TO THE ARMY AND NAVY...

That is why we haven't been able to do very much for our friends in civilian clothes.

Carload after carload has gone out from GRUENDLER to all parts of the world.

Working for the Army and Navy has been a great experience—and a good one too. We have learned a lot of things that are going to make GRUENDLER CRUSHERS do a better job in a better way than ever before.

Some units have now been released and are in production. Write for data and delivery dates.—The unit you want may be available.



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CRUSHER and PULVERIZER CO. • ST. LOUIS 6, MISSOURI

New Distributor for Davey

Davey Compressor Co. of Kent, O., has announced the appointment of Cliff Miller Machinery Co., 215 North Twelfth St., Omaha, Neb., as a new franchise dealer for Davey products.

Appointed Sales Manager for Leschen

Douglas W. Vernon has been appointed general manager of sales for A. Leschen & Sons Rope Co., St. Louis, Mo.

Promotions by International Harvester

M. F. Holahan, after 50 years with International Harvester Co. and one of its predecessor companies, has ended his services as first vice president. He will remain a member of the Board of Directors, and will be available to the management in a consulting capacity. J. L. McCaffrey, former second vice president, will succeed Mr. Holahan as first vice president. Mr. McCaffrey, also a member of the Board of Directors, is a former vice

president in charge of sales. W. E. Worth, former vice president in charge of supply and inventory, has been elected second vice president to succeed Mr. McCaffrey. Four other changes in the officer group of the Harvester Company have been announced. Mercer Lee, former assistant to the vice president, has been elected vice president, and will be in charge of supply and inventory. Peter V. Moulder, general manager of the Motor Truck Division, R. P. Messenger, general manager of the Farm Implement Division, and Ralph C. Archer, general manager of the Farm Tractor Division, have been elected vice presidents. They will continue as executive heads of their respective divisions.

Becomes Managing Director Concrete Pipe Association

Howard F. Peckworth, formerly assistant to the secretary of the American Society of Civil Engineers, on April 1 became managing director of the American Concrete Pipe Association, Builders Bldg., Chicago. Previous to his connection with the society he was for 14 years in responsible charge of heavy construction projects in various parts of the country. With the American Society of Civil Engineers he was successively Editor



H. F. Peckworth



T. J. Kauer

of "Civil Engineering" and Assistant to the Secretary. While in this latter position he has visited and spoken before groups of engineers in all parts of the country. At the same time T. J. Kauer was appointed Assistant Managing Director of the American Concrete Pipe Association. Mr. Kauer has been Assistant to the President and Washington Representative of that Association and will continue his office in the Munsey Building, Washington, D. C. Mr. Kauer began his employment with the American Concrete Pipe Association in Washington, D. C., in 1941.

Staff Additions to Eutectic Welding

C. F. Patterson has joined the rapidly expanding field engineering staff of the Eutectic Welding Alloys Co., New York. He will serve Eutectic's customers in Michigan. John A. Owen has joined the staff and will serve as field engineer for North Carolina.

J. F. Richardson Elected Vice President Buffalo-Springfield

J. F. Richardson, formerly sales manager, has been elected vice president and secretary of the Buffalo-Springfield Roller Co., Springfield, O. Except for service in the armed forces for about four years before, during, and after World War I, Mr. Richardson has devoted his entire career since 1904 to the marketing of heavy construction equipment, especially Buffalo-Pitts, Kelly-Springfield, and Buffalo-Springfield rollers. One of the early members of the American Road Builders' Association, Mr. Richardson attended his first convention of that organization at Elmira, N. Y., in 1906.

Athey President Dies

C. Kier Davis, President of Athey Truss Wheel Co., Chicago, Ill., died as a result of an

automobile accident which occurred in Chicago on March 7, 1945. He became associated with the Athey Company in 1936 as secretary and treasurer. In 1937 he



was made a director of the corporation and since October 1940 served as its president. He is survived by a son, Col. Leonard K. Davis, serving with the U. S. Marine Corps.

New Export Director for Universal Engineering Corp.

D. H. Young, 120 Broadway, New York 5, N. Y., has been appointed director of exports for the Universal Engineering Corporation, Cedar Rapids, Ia. Mr. Young will appoint dealers in countries throughout the world with the exception of Russia, Canada, Mexico, Hawaii and the Philippines, where existing distributors will continue to serve the Universal Engineering Corporation.

Asphalt Institute Elects Officials

The Board of Directors of The Asphalt Institute have elected H. B. Pullar of Berry Asphalt Co., Chairman of the Executive Committee, with Ole Berg, Jr., Union Oil Co. of California; C. E. Cox, Carter Oil Co.; F. R. Field, Standard Oil Co. of New Jersey; A. M. Maxwell, Standard Oil Co. (Ohio); F. V. Widger, Witco

IT'S AS EASY AS

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TO PREVENT CRACKING
IN CONCRETE ROADS
WITH

FLEX-PLANE
INSTALLERS

Flex-Plane Dummy Joint Installing Machines are the best means for producing joints in concrete roads. You recall the first concrete roads . . . no joints. Next came the parting strip down the center . . . then the dummy longitudinal and transverse joints widely spaced between expansion joints. Each step reduced cracking; now machine-in-

stalled joints, closer spaced, virtually eliminate cracking.

Ask for data and specifications, plus 22 reasons why **Flex-Plane machine-installed Dummy Joints** will make your concrete roads better.

**FLEXIBLE ROAD JOINT
MACHINE COMPANY**

WARREN, OHIO

Chemical Co., and J. S. Williams, Rock Island Refining Co., completing the committee. The five Vice-Presidents elected with their respective divisional jurisdiction, were as follows: Division 1: Atlantic-Gulf, F. R. Field; Division 2: Ohio-Great Lakes, A. M. Maxwell; Division 3: Mid-West, C. E. Cox; Division 4: Southwest, J. S. Williams; Division 5: Pacific Coast, Ole Berg, Jr. Bernard E. Gray was re-elected as general manager-chief engineer and Herbert Spencer, president of the Institute. George R. Christie, Socony-Vacuum Oil Co., Inc., was also re-elected secretary and treasurer, with John N. Smith of the same company continued as assistant treasurer.

W. B. Pringle New Manager New York Office Caterpillar

W. B. Pringle, manager of Caterpillar Tractor Co.'s Berwick, Pa. office since June, 1944, has been appointed manager of the company's New York office, succeeding the late George E. Churchill. Don E. Kneer, successively export credit manager, domestic credit manager and supervisor of priorities in "Caterpillar's" executive offices at Peoria, Ill. succeeds Mr. Pringle as manager of the Berwick office, to which he was transferred more than a year ago.

**"NO TROUBLE WHATEVER
IN PRODUCING
1100 TONS
PER 10 HR. SHIFT**



with our H & B ASPHALT PLANT"
says W. W. King, of King Paving Company, Ltd.



FLUIDOMETER
Automatic Metering System
—saves time, materials, insures accuracy and uniformity. For all types of plants.

• Typical of the dependable and efficient operation of Hetherington & Berner Asphalt Plants is the performance record of the Marysville (Ont.) plant of King Paving Co., Ltd., Oakville, Ont. According to Mr. W. W. King, president, this H & B plant has proved 100% satisfactory, and "has come up to—and beyond—our expectations in every way, shape, form and manner."

"We have had no trouble whatever with the plant," says Mr. King, "and no difficulty in producing 1100 tons per 10 hour shift."

This dependable performance is the result of our nearly half a century of experience and recognized leadership in asphalt plant design and construction. America's first builders of such equipment, H & B today offers the latest improvements and refinements in portable and stationary asphalt plants. Write for descriptive literature.

HETHERINGTON & BERNER INC.
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New Headquarters for Goodyear Tire Sales Offices

Managers of the five divisional tire sales offices of The Goodyear Tire & Rubber Co., Inc., are now headquartered in their territories, instead of in Akron. L. H. Shepherd, Southeast Division manager is at Atlanta; F. W. McConky, Jr., Northeast Division head, at New York City; and A. Jae Sears, in charge of the Northcentral Division, will be in Chicago. E. L. Melford is Western Division manager, with offices in Los Angeles, and James

A. Bailey is manager of the Southcentral Division at Dallas.

Ed Reed Again with H. O. Penn Co.

R. E. Reed after serving with WPB and later with Michigan Tractor & Machinery Co., has returned to the sales staff of H. O. Penn Machinery Co. He is now established at the newly opened Newington, Conn., branch, where he will be associated with Stewart A. Wade, Branch Manager, and Guy Berger.

New General Sales Manager for Aeroil

Bernard Gould, formerly in charge of dip tank sales, has been appointed general sales and advertising manager of the Aeroil Burner Co., Inc., of West New York, N. Y. Branch offices are located in Chicago, Dallas, and San Francisco. Ed Skillman, formerly with the N.A.M. in New York has taken over the Wood Burner Division of the company as assistant sales manager.

3-M Co. Appoints C. P. Pesek Engineering Administrator

Appointment of C. P. Pesek, Minneapolis, as administrator of engineering of Minnesota Mining and Manufacturing Co., St. Paul, Minn., has been announced by R. P. Carlton, vice-president in charge of manufacturing.



C. P. Pesek



W. A. Thomas

W. A. Thomas, St. Paul, assistant chief engineer, was made engineering consultant on Mr. Pesek's staff. Mr. Pesek has been with 3-M Company since Jan. 10, 1944, preparing plans for expansion of plant in connection with the firm's plan to resume its pre-Pearl Harbor expansion program in the immediate postwar period.

Wickwire Spencer Appoints Henry Davis to Head Market Research

The Wickwire Spencer Steel Co. has announced that Henry Davis will be in charge of the company's newly formed Market Research Department. Mr. Davis has been connected with Wickwire Spencer for some years. He was most recently in the sales department of the Hardware Division. The new Research Department of the Company will be organized to supply current market data for all of Wickwire Spencer Sales Divisions. Present plans call for greatly increased sales and merchandising activities post war. It is expected that the Research Department will contribute considerably to the success of this. Mr. Davis will make his headquarters at 500 Fifth Ave., New York 18, New York.

J. H. Patterson, Manager Cummins Diesel Export Corp.

J. H. Patterson has been appointed manager of the Cummins Diesel Export Corporation, subsidiary of the Cummins Engine Co., Inc., Columbus, Ind., manufacturers of heavy-duty diesels for automotive, marine and industrial service. Offices of the Export Corporation are located at 6303 Chrysler Bldg., New York 17, N. Y. Mr. Patterson has specialized in the development of service and sales organizations for the past 20 years. Prior to his appointment as Cummins Export Manager, he was division manager of the National Refining Company.



J. H. Patterson

Ralph L. Johnson, V. P., with H. O. Penn Organization

One of the policies in the rapid growth of the H. O. Penn Machinery Co., Inc., of New York City, has been the advancing of members of its staff to keep pace with company expansion. Along this line Ralph L. Johnson, sales engineer, has recently been made Vice President and Sales Manager.

Eleven years ago Mr. Johnson joined the organization as a sales engineer and rapidly advanced to the post of Sales Manager, then Secretary. Mr. Johnson is a graduate of the School of Mines, U. of Minnesota, and spent several years in the construction industry and in the sale of construction machinery before coming with the Penn organization.

Name Walker Manager of Mack N. Y. Division

Appointment of Willard Walker, vice president of Mack-International Motor Truck Corp., to the managerial post of the Greater New York Division has been announced by C. T. Ruhf, president of Mack trucks, Inc. For the past five years Mr. Walker had been head of Mack's Government Department. Mr. Walker has been division bus manager in the South for Mack, and later was associated with the firm's home office in New York City in a variety of executive capacities. As vice president in charge of sales and service of the Greater New York Division he will make his headquarters at 625 West 42nd Street.



Effective Crowd Control

Regardless of the material being handled, Insley Excavators save time on the job. Crowding speed is under perfect control at all times . . . fast or slow to provide whatever crowding pressure operating conditions require. Faster retraction is obtained by the reversible, two-speed front drum. Boom can be raised or lowered without adjusting the crowding drive.

This is but one detail of Insley design

and construction that contributes to reduced dirt or rock moving costs . . . but one of many reasons why it will pay you to consider Insley Excavators for new equipment needs when production for civilian use can be resumed. Write now for specifications on the Insley Excavator . . . $\frac{3}{8}$ and $\frac{1}{2}$ -yd. sizes . . . six easily interchangeable attachments, shovel, trench hoe, basement hoe, dragline, clamshell and crane.



INSLEY MANUFACTURING CORP., INDIANAPOLIS 6, IND.

Degnon Heads Mack New England Division

P. J. Degnon, vice president of Mack Motor Truck Co., has been appointed manager of the firm's New England Division. He will make his headquarters in Boston. He started with Mack in 1919 as branch manager of Atlanta, Ga., following service as a first lieutenant in motor transport during the last war. He later was named manager of the Southern Division and in 1925 was appointed vice president in charge of Mack's sales and service in the South. Then in 1933

he was transferred to New York and managed the metropolitan area until his present appointment.

W. E. Moore Appointed District Sales Manager

Walter E. Moore was recently appointed district sales manager for the New York District of the American Cable Division of American Chain & Cable Co., Inc. Mr. Moore, who has been with the company for 18 years, will continue to make his headquarters at 230 Park Ave., New York, N. Y.

Timken to Have Canadian Plant

The Timken Roller Bearing Co., Ltd., Canadian subsidiary of The Timken Roller Bearing Co., Canton, O., has purchased 75 acres of land at St.

Thomas, Ont., as a site of a new bearing and rock bit plant. Designs of the plant building will be started immediately, and operations requiring 300 employees will begin as soon as possible.



Today, It's a Battle
of **MOVEMENT!**

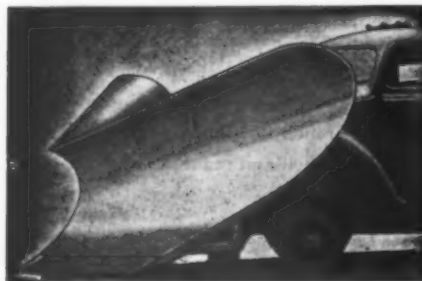
You can increase efficiency and simplify operations of almost any type of equipment by making it portable. Investigate the uses of EWC Wheels, Axles, Springs, Tongues, etc., to give your equipment added value. Write today for illustrated Bulletins, and for sound engineering help based on more than half a century of experience.

Make Your Machines Mobile with EWC Mountings



EWC WHEELS

Electric Wheel Co.,
Dept. R3 Quincy, Ill.



ROOT INTERCHANGEABLE SNOW PLOWS

Highway Commissioners, Road Engineers and Supervisors of road maintenance prefer Root Interchangeable Snow Plows for opening up streets, highways and airport runways, removing barriers of snow and ice. Get the facts, investigate maintenance costs...you'll understand the reason why Root plow units "get the nod" when purchasing decision is made by those charged with snow removal in the road, street and airport field.

Write for Bulletin

**ROOT SPRING
SCRAPER CO.**

Kalamazoo 11, Michigan
Builders of road maintenance
equipment since 1890

To Get the STRONGEST WELDS Use ...



When repairing any of your equipment in the field or in your shop, use Tournaweld. Easy to apply. Stands up in hardest service. Available in 7 types—sizes ranging from 1/8" through 5/16", to meet all heavy equipment welding requirements. Developed and produced by LeTourneau for the manufacture of heavy-duty equipment. A premium rod designed for a special purpose... it will pay you to use Tournaweld on your LeTourneau and other construction rigs. TWI



LeTourneau Distributor
R. G. LeTOURNEAU, INC.
Peoria 5, Ill. Stockton, Calif.

Matt Koener Promoted by Caterpillar

Matt Koener has been appointed chief inspector for Caterpillar Tractor Co. to fill the vacancy caused by the recent resignation of M. D. Johnson, chief inspector for the past 15 years. Mr. Koener joined a predecessor company, the Holt Manufacturing Co., as an assemblyman in 1919. A year later he became a field engineer for the service department, both in this country and abroad, and for 18 months served, on a loan basis, the Andean National Corp. in Colombia, South America, where he supervised repair work on a pipeline project in the oil fields. In 1927 he was assigned to gear inspection in "Caterpillar" Peoria, Ill. plant, becoming a supervisor in the inspection division six months later. In 1934 Mr. Koener was made assistant chief inspector and remained in that position until his present promotion.

Ray C. Nesbitt Appointed Sales Engineer of Barnes

Ray C. Nesbitt has been appointed sales engineer of Barnes Manufactur-

ing Co., Mansfield, O., with headquarters at Mansfield. For the past two years he has been connected with the Construction Machinery Branch of WPB in Washington, D. C. Prior to



R. C. Nesbitt

that, he was associated with Ed. Phillips Co., construction equipment distributors in the Middle Atlantic States. Mr. Nesbitt has had a wide experience in the construction field, both sales and engineering.

Egan New District Manager Sheffield

Sheffield Steel Corporation has announced the appointment of Alfred B. Egan to the position of district manager, Chicago District. Mr. Egan has been with Sheffield 16 years. For many years he was in charge of the Des Moines office. Since 1942, he has been in charge of the Sheffield Washington, D. C. office. The Chicago offices are at 310 South Michigan Ave.



A. B. Egan

Redditt Succeeds Gentry as Texas Road Chief

John S. Redditt, President Texas Good Roads Association, has been named chairman-member of the Texas Highway Commission. He succeeds Brady Gentry, who served as President of the American Association of State Highway Officials in 1943 and was a national leader in highway legislative and administrative matters.

Fruehauf Western Expansion

The Fruehauf Trailer Co. has purchased Trombly Truck Equipment Co., Portland, Ore. According to W. J. Jarvis, Portland Branch Manager of Fruehauf, this new addition to the firm's facilities in the northwest is part of an overall western expansion program planned to further expand service to users of trailers. The Trombly shops will operate in conjunction with Fruehauf's present Portland plant.

Booklets and Pamphlets Received

Expressways, Reference Book on Planning and Design, with illustrations of typical highways. Published by the Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill.

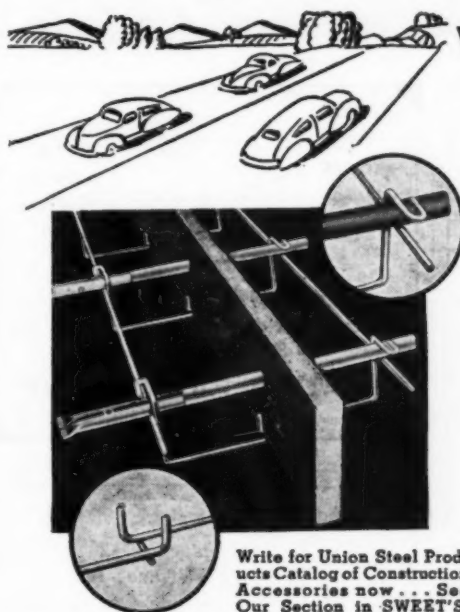
Le Tourneau's Annual Report for 1944 has been issued in an attractive illustrated form. This interesting and informative booklet is available on request to R. G. Le Tourneau, Inc., Peoria, Ill.

The Linn Haftrak and the Linn Catruk, those hard duty vehicles for all types of off-the-highway service, are illustrated and described in a new bulletin just issued by The Linn Manufacturing Corporation, of Morris, N. Y.

Types shown include Linns with various types of bodies for moving rock, coal and ore; side-tipping dump body; Linn pole trailer with log bunks for logging; snow plow mounting. The Catruk models, equipped with four wheels and tracks, permit operation as a truck or half-track, according to ground conditions. Rear wheels hydraulically retractable.

The bulletin which has been printed in English, Spanish and Portuguese, will be sent free on request to anyone interested in moving loads from 5 to 10 tons, where steep grades, deep mud, snow and ice, sand rocks make negotiation with wheeled vehicles impractical.

True To Name . . .



"QWIK-LOCK"

Expansion Joint Assemblies

For easy installation and fool-proof functioning, "QWIK-LOCK" Expansion Joint Assemblies can't be beat. They are designed to make it easy to position and lock dowels, absolutely parallel to each other and to the subgrade. Thus they speed up road building and assure better joints at lower cost.

Write for Union Steel Products Catalog of Construction Accessories now . . . See Our Section in SWEET'S.

UNION STEEL PRODUCTS COMPANY

417 Pine Street, ALBION, Michigan

CONCRETE & BUILDING SPECIALTIES, LTD.
3334 Danforth Avenue, Toronto, Canada

WILLIAMS WALLACE COMPANY
100 Hooper Street, San Francisco, Calif.

SAUERMAN

Long Range Machines



Explanation of Picture — The above picture of a small Sauerman Scraper digging gravel from pit and delivering to crushing plant shows the simple effectiveness of this method. This particular Sauerman machine consumes $4\frac{1}{2}$ gals. of gasoline to move 45 cu. yd. of material per hour.

WRITE FOR CATALOG

SAUERMAN BROS., Inc.

588 S. CLINTON ST., CHICAGO 7, ILL.

Dig, Haul and Dump • • for a few cents a yard

MANY jobs of digging and stockpiling are simplified by using a Sauerman Power Scraper or Cableway.

This equipment is very flexible and is readily adapted to any ground conditions. First cost is reasonable, maintenance expense is small and the simplicity of operation permits easy one-man control of even the largest Sauerman installation.

There is a size and type of Sauerman machine to meet every capacity requirement from ten cubic yards an hour to many thousand cubic yards a day. And each machine, large or small, offers greatest possible economy of power and labor in its appointed task.

Clearing House

Tanks In Stock

18 Heavy Rail Car Tanks
4000, 8000, 10,000 with and without coils

L. M. STANHOPE

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Status of Public Works Planning and Its Relationship to Full Employment. This 24 p. booklet, APW Bulletin No. 20, is the first of a series to be issued replacing the usual Public Works Engineers Yearbook. Others will be issued at intervals of two to four weeks, presenting 1944 Public Works Congress papers. Available at \$1.00 from American Public Association, 1313 E. 60th St., Chicago 37, Ill.

31st Annual Report (year ending June, 1944) Country Road Board, Dept. of Public Works, Melbourne, Australia.

Post-War Notes

Keep Up Postwar Planning Warns AGC Leader

Postwar planning must continue despite official efforts to bring about a more sober attitude toward the war on the part of the public, cautions H. E. Foreman, managing director of the Associated General Contractors of America.

"Certainly war work must not be neglected," he said, "but to kill off now all thought or all preparations for the future would be to invite cha-

otic conditions within this country when the war ends."

Mr. Foreman pointed out that the construction industry has the capacity to reach an operating rate which will provide 2,400,000 on-site and stimulate 5,000,000 off-site jobs within a year after the war. It can do this only provided plans and specifications are drawn up in advance so that an immediate start can be made on hundreds of projects when conditions permit.

"There are all kinds of construction projects—new factories, highways, homes and water systems—which are necessary. In order that work may start on them when employment is needed most, competent architects, engineers, contractors, public officials, business leaders and others must translate dreams into blueprints, specifications and working plans in advance.

"If that is done, millions of regular jobs at regular pay and legitimate business opportunities will be available in construction and many other industries when employment is needed most after the war. If this advance planning is not done, the nation will lose the benefits it could secure from the greatest single source of industrial employment immediately."

To Designate Routes for National Interstate

The Public Roads Administration has requested state highway departments to submit by July 1 maps and supporting data of the routes tentatively designating the new national system of interstate highways. On the basis of these proposals a system conforming to the 40,000-mile limitation will be designated by subsequent agreement of the states and the Public Roads Administration and submitted for approval by the Federal Works Administrator.

In making the announcement Thomas H. MacDonald, Commissioner of Public Roads, states: "Designation of the system is an important step toward launching a large post-war highway program. Construction of such a system is an outstanding feature of the long-range highway program. The recent federal legislation authorizes \$225,000,000 for the federal-aid highway system and \$125,000,000 for urban highways in each of the first three post-war fiscal years. These funds will be available for improvement of the national interstate system and other highways."

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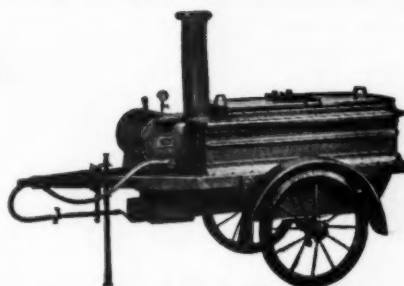


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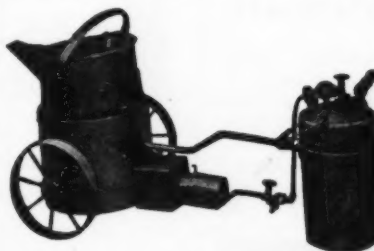
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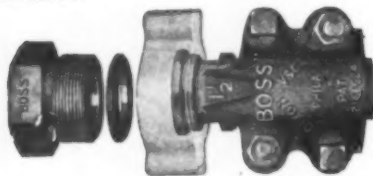
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